Yellow Series

Massimo Tessitori

Mikoyan Gurevich
MiG-1/MiG-3

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Massimo Tessitori

Mikoyan-Gurevich MiG-1 / MiG-3

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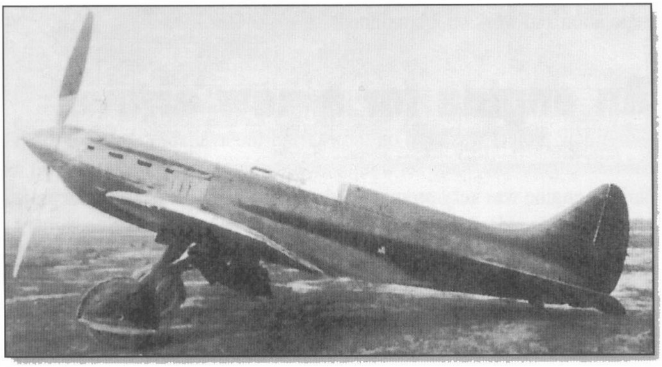
Previous page.
MiG-3 captured by the Germans.

Stratus coll.

K-project (or X-project) The king of fighters

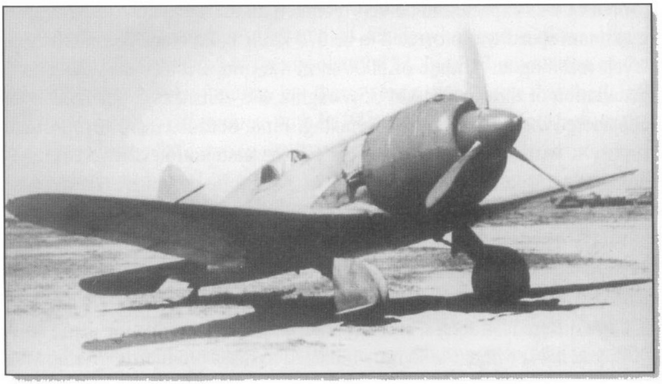
In the late '30s Nikolai Nikolaevich Polikarpov, the so-called "king of fighters", was the most important fighter designer in the USSR. He designed many fighters, some of which were extremely advanced for their time, such as the well-known I-16 and its intended successor with an in-line liquid-cooled engine, the I-17.



I-17 prototype, portside profile.

While developing the I-17 fighter, Polikarpov proposed a more advanced derivative, the I-19. However, this project was stopped when, early in 1936 Polikarpov was appointed simultaneously as chief designer of the plant n.2 in Gorki and of the plant n.8 in Khimki, where there was no experimental aircraft development. Nevertheless, in 1937/38 Polikarpov continued to work on his promising fighters with liquid-cooled engines, designing the I-172 and I-173.

In 1938 the first sketches for the I-180 were made. The first I-180 was built at Zavod n.156 in the summer of 1938, but the Defence Industry Ministry brought forward the maiden flight, even though the prototype wasn't completely ready. On December 15, 1938 the first flight ended with an engine



I-180 prototype.
Note, all unmarked photos via author.

failure that resulted in the loss of the aircraft and the death of the famous test pilot V.P. Chkalov. The death of this Hero of the Soviet Union was followed by the arrest of Polikarpov's deputy, Dmitry Tomashevich, and other people, wrongly accused of sabotage; Polikarpov was not arrested because he had not given his personal consent to the flight.

After reorganisation and transfer of the Polikarpov KB to the new Zavod 1 at Vnukovo near Moscow, Polikarpov resumed working on the I-180, whose second prototype was flown successfully on April 19, 1939. After 52 successful flights, the oil cooler ruptured from excessive pressure, blinding the test pilot Tomas Suzi. He bailed out, but was unable to open his parachute and died. Despite these accidents, the aircraft still enjoyed a favourable reputation and work on it continued.

An engine for a new arrow

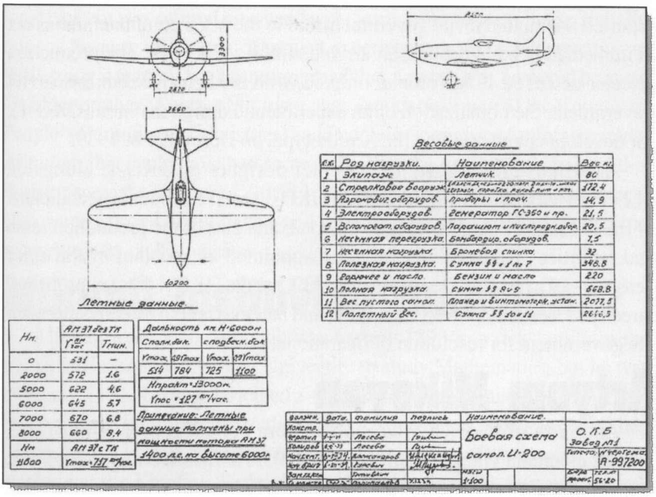
A new project was born on the basis of the availability of the Mikulin AM-37 engine, projected for a high altitude bomber and never utilized for it. This engine was very promising, despite its heavy weight, so the project manager Alexander Mikulin contacted Polikarpov to solicit the construction of an airframe suitable for it. Polikarpov was interested to use his experience from the abandoned I-17 project. He decided to draw up a high-altitude interceptor with the Mikulin engine, that was at first designated as project X, or project K. This was to be the smallest airframe that could contain the (rather large) engine.

Project X starts

The official work program for 1939 considered the production of three prototypes of the aircraft X by July 1, 1940, but Polikarpov didn't begin work immediately because of the troubles with the I-180 program. Only in August 1939 did Polikarpov put together a team to prepare a preliminary design of the new aircraft; this comprised Y.Seletskiy, Nikolay Matyuk, Mikhail Gurevic, Alexey Karev and Vladimir Romodin. At first, Mikoyan was involved only marginally, and in an unofficial way.

The design of the new fighter was ready in October 1939. Its flight performance was expected to be very good. With the 1400 hp AM-37 engine, maximum speed was projected to be 670 km/h at 7000 and 531 km/h at sea level, reaching an altitude of 5000 m in 4.6 min. Besides the AM-37, the installation of the similar AM-35A engine was considered, but Polikarpov considered the AM-37 more promising. First, because it was proposed to supply it with synchronisation gear for the installation of two fuselage-mounted guns, and in the second place, a 1900 hp derivative, the AM-39, was expected for late 1941. Also considered was the installation of two TK turbo-chargers on the AM-37, to theoretically increase maximum speed to 717 km/h at an altitude of 11600 m.

Although similar in shape to the I -200 as later built, the original Project X had a different structure, as it was intended for the production capabilities of Zavod n.21, where Polikarpov intended to mass produce it. "Removable



№	Род нагрузки.	Наименование	Вес кг.
1	Экипаж	Летчик	80
2	Стрелковое вооруж.	[illegible]	172.4
3	Аэронавиг. оборудов.	Приборы и проч.	14.9
4	Электрооборудов.	Генератор ГС-350 и пр.	21.5
5	Вспомогат. оборудов.	Парашют и кислородн. обор.	20.5
6	Несменная перегрузка.	Бомбардир. оборудов.	7.5
7	Несменная нагрузка.	Броневая спинка.	32
8	Полезная нагрузка.	Сумма §§ с 1 по 7	346.8
9	Горючее и масло	Бензин и масло	220
10	Полная нагрузка.	Сумма §§ 8 и 9	568.8
11	Вес пустого самол.	Планер и винтомоторн. устан.	2077.5
12	Полетный вес.	Сумма §§ 10 и 11	2646.3

Нм.	АМ37 без ТК	
	V км/час	T мин.
0	531	–
2000	572	1.6
5000	622	4.6
6000	645	5.7
7000	670	6.8
8000	660	8.4
Нм	АМ37 с ТК	
11600	Vmax = 717 км/час	

Дальность км. Н=6000м			
С подв. бак.		С подвесн. бак.	
Vmax.	0.9Vmax	Vmax.	0.9Vmax
514	784	725	1100

Нпракт = 13000 м.

Vпос = 127 км/час.

Примечание: Летные данные получены при мощности мотора АМ 37 1400 л.с. на высоте 6000 м

Должн.	Дата	Фамилия	Подпись
Констр.			
Чертил	[illegible]	Лосева	
Копиров	[illegible]	Лосева	
Кон. Серт.	[illegible]	Александров	
Нач. бриг.	[illegible]	[illegible]	
Зам. гл. кон.		[illegible]	
Гл. констр.	[illegible]	[illegible]	

Наименование. Боевая схема самол. И-200

О.К.Б. Завод №1

№ чертежа А-997200

Масшт. 1:100

One of the first drawings of the I-200.

wing panels, detachable fuselage components (wooden rear part and metal aft section) and the undercarriage with conventionally simple retraction mechanism, give wide opportunities for mass production with efficient usage of the production area. A limited number of quite simple connections allow easy and quick change of spare parts in any maintenance conditions", wrote N.N.Polikarpov in his report on the draft design of Project X. Although the characteristics of the aircraft were promising, Polikarpov did not hurry to send Project X for the approval of the Soviet government. His analysis of the current trends in aviation suggested that a decrease in wing area would improve the aerodynamic properties. However, he didn't get the chance to do this.

Project X changes hands

During October 1939 Polikarpov went to Germany with an aeronautical delegation to study the German aircraft industry. These experiences confirmed the validity of his design developments. In November 1939, during Polikarpov's absence, a special meeting was held at Zavod n.1 in Moscow-Vnukovo, where at that time his KB was located, to decide what type of plane should be produced there instead of the obsolete I-153. Limited production of the BB-22 bomber was continuing, but there were many doubts that the I-180 was modern enough to compete with Bf109s; the delays and accidents to the prototypes were also creating doubts. On that occasion Yakovlev reported the development of his I-26 fighter, and the commission, after examining the documents, recommended this aircraft for the series production at Zavod 1. Chief designer A.T.Karev was present at the session, and in spite of Polikarpov's prohibition on reporting his KB developments without his approval, he described Project X. This was estimated to be 70 km/h faster than the I-26. This report was not wholly believed, as the performance of Project X seemed too high. The works manager, A.Voronin, gave further information on the reported this to the Soviet government and to the VVS command. An order to immediately build the aircraft arrived within a few days. The production director of Zavod 1, A.Voronin, ordered, with the agreement of the Soviet government, the organization of an experimental design division (OKO-1), for developing and building the X prototype, on December 8, 1939.

A.I.Mikoyan was assigned as chief designer of OKO-1, alongside M.I.Gurevich and V.A.Romodin. The OKO-1 received about 80 technicians of the Polikarpov bureau, 40% of the total, and part of the production team and facilities. Mikoyan was formally appointed as assistant of the chief designer of Zavod 1 on December 14, 1939, but the OKO-1 was subordinated directly to Voronin, not to Polikarpov, and had the right to directly approach the government for resolution of operational problems.

Artyom Mikoyan

Anushavan Ivanovich Mikoyan was born in Sanain (now Tumanyan), a small mountain village in Armenia, in 1905. He first saw a plane in 1918, when his family took refuge in the mountains during a Turkish invasion. This was a Farman biplane that made an emergency landing there, and impressed the young Mikoyan. After the sudden death of his father, he went to Tbilisi to live with his relatives. Here he became familiar with communist ideology. His older brother Anastas had already started his career in the Bolshevik party. In 1921 Anushavan formed the first Komsomol (communist youth organization) in Sanain. In 1923 he went to live in Rostov, where he studied at a professional school and then worked as a lathe operator. He stood out for his conscientious attitude to work, was invited to join the communist party in 1924, and moved to Moscow. Here he worked again as a lathe operator, and contracted tuberculosis. His nickname Artyom originated in this period. In 1928-1930 he had to perform military duty, at first in the infantry, and he was then promoted to the Frunze Military Academy at Orel. After the military service, he worked as a mechanic in Moscow. Then he accepted sponsorship for the Air Force Academy Y. Zukovsky that was the centre of Soviet aviation science, where he obtained a pilot's licence and also qualified as a parachutist. Before taking his degree, Mikoyan had to work at the Kharkov establishment, where he worked on the TsKB-7 gunship under the leadership of Dmitri Grigorovich

Returning to the Zhukovsky academy in 1936, he and his fellow student K. Samarin proposed a new sports plane with a pusher engine and canard layout. This was approved by the Academy, and a prototype was built, giving Artyom his first experience as a design team leader. Artyom graduated as a Red Army Air Force Mechanical Engineer in October 1937. In 1938, he started to work with Polikarpov's team as an inspector for newly built planes at Zavod 1 in Khodinka (then a suburb of Moscow); this gave him contact both with designers and with the production line. He had to frequently contact both designers and production technicians, obtaining excellent experience and gaining credits thanks to his skills. His first independent work was on the gun system and overheating problems of the I-153 prototypes. Besides this he worked on a commission studying the causes of air accidents.

Mikoyan was offered his own design team in September, but he initially refused because of his lack of project experience and his strong position in Polikarpov's team. It has been suggested that Artyom was favoured because his elder brother, Anastas Mikoyan, was deputy chairman of the Council of People's Commissars (ministries) and People's Commissar for foreign trade. Although this could have had some influence, the main people behind this decision were the director of Zavod 1, Voronin, and his deputy V.Dementeev, who were worried about delays and problems because Polikarpov had too many projects on his hands.

Mikhail Iosifovich Gurevich

Mikhail Iosifovich Gurevich was born in 1893 to a rich family in the Ukraine. He went to Kharkov University to study Mathematics, but he was expelled in 1911 because he joined a student movement against the monarchy. He completed his university studies at the Aeronautic Academy in Paris, then he returned in Russia, where he completed his studies of mathematics while teaching at the Kharkov Technological Institute. In 1923, he went to work at the TsKB. In 1928-1931, he collaborated with the French designer Paul Richard on the TOM-1, a twin engine float-monoplane, but the design team was dissolved when the hydroplane was not ordered into production. Then he worked at TsAGI, where he designed and built one of the first Soviet gyroplanes, and also worked on some assault planes. In 1936, Mikhail went on an official delegation to the USA to buy a licence to produce the DC-3 in the Soviet Union. In 1938 he became Polikarpov's deputy, heading the preliminary drawings bureau. Mikoyan and Gurevich became friends. While Mikoyan had excellent skills in organisation and leadership, Gurevich was mainly a skilled designer, and their attitudes were complementary.

The fall of the king of fighters

The formation of the OKO-1 occurred without the agreement of the management of Polikarpov's bureau, and this led to a stressed relationship. Gossip had it that Polikarpov could be shot when he returned from Germany. Many raised questions about the strange way OKO-1 had been formed, during Party meetings in December 1939. Polikarpov, after returning from Germany, noted the reallocation of many technicians from his bureau with bewilderment. Although not yet dismissed from his role as chief designer of Zavod n.1, he wrote to the head of the central committee, but this yielded no results. During a conference about the division of projects, chaired by the chief engineer of Zavod 1, P.V.Dementyev, Polikarpov was asked about his complaints directed to the government. He bitterly answered that he had complained to the People's Commissar of Aircraft Industry, M.Kaganovich, but that the latter was removed from his duty and committed suicide some days later, so there was no-one to address a complaint to, except that while in Germany one could complain to Goering. By the reaction of the others present, he realised he had said too much and changed his tone, giving his consent to the development of the I-200 by Mikoyan, and claimed to have other projects. The transfer of the Polikarpov KB into the new but smaller experimental plant n.51, also in Khodynka close to Zavod 1, was decided at the beginning of 1940 and took place in July. However, Polikarpov received an award for his role in the preliminary studies on Project X.

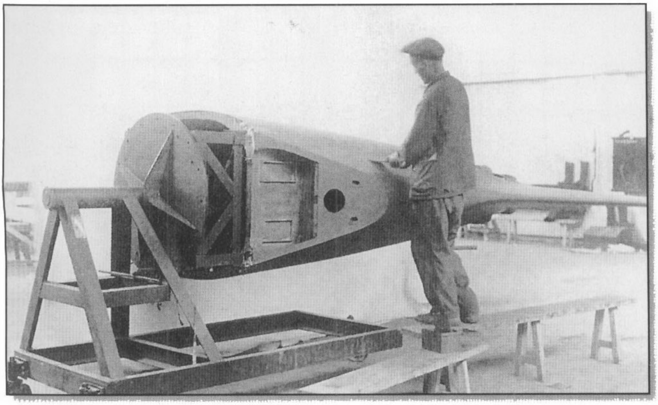
I-200 development

During March the Mikoyan and Gurevic OKB-155 (experimental design bureau) was officially instituted in Zavod 1. Mikoyan, out of respect for his friend and colleague, insisted that the bureau should carry both their names. In fact, having headed the Polikarpov bureau's preliminary design group for project X, Gurevich could be regarded as the true designer of this aircraft. The task of the bureau was to develop two variants of project X: the Izdelye 61 with the AM-35A engine, and the Izdelye 63 with the AM-37. On January 21, 1940, these aircraft were redesignated I-200. War appeared imminent, and so the government offices gave Mikoyan the date of July 1st 1940 as a deadline for the state acceptance trials. This was going to be difficult to achieve, because they had started slowly, and because the Lavochkin I-301 and Yakovlev I-26 projects were months in advance in terms of development time. But Mikoyan was an excellent organizer. To gain time, they started immediately to prepare production facilities while simultaneously building the prototypes. They received massive help from production technicians at Zavod n.1. Polikarpov aided the OKB, too; he noted that the production of the aft fuselage section, designed for the technology of Zavod n.21, would meet difficulties at Zavod n.1. The development of drawings for the I-200 was sufficiently fast. Small changes to the initial project were made:

- for improved directional stability, the area of the rudder was slightly increased;
- the cowling was designed to tightly encase the engine, so the oil radiators were in fairings outside the cowling, while control of the air flow was made by shutters at the oil radiator inlets, not at the outlets (however, on the second and subsequent versions of the machine they returned to the initial idea);
- the AM-37 engine was still under test; so the AM-35A equipped the first prototypes.

I-200 n.01, 02 and 03

The work on I-200 drawings began on 25 November 1939. It differed from Project X because it had to be equipped with the Mikulin AM-35 engine; this was because the AM-37 was not yet ready for production. The AM-35A had the same dimensions, but its power was 200 hp lower. The drawings were completed and were submitted to the authorities on 8 December1939, and on 25 December a mock-up was completed and approved. It was used for tests in the TsAGI T-101 wind tunnel. Such tests were concluded on January 2, 1940 and confirmed the good aerodynamic shape of the airframe, even if they judged that the projected performance was optimistic. Thanks to the help of technicians at Zavod 1, and his experience as production technician, Mikoyan divided the I-200 into sub-assemblies that could be produced separately and then easily assembled together by a small number of simple connections. This modular conception was favourable both for mass production and for mainte-



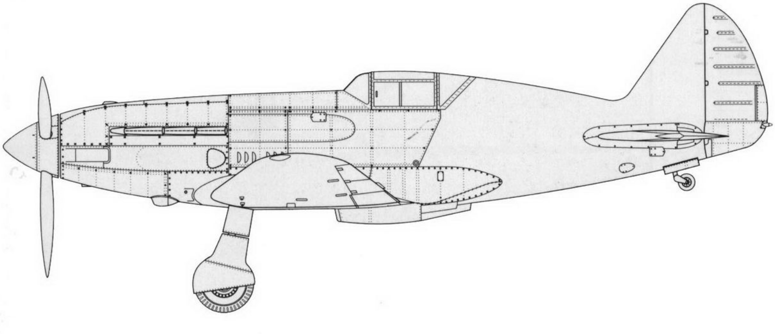
I-200 ***prototype*** *under* *construction.*

nance, allowing quick removal and replacement of damaged sub-assemblies even under field conditions. Wide use was made of cast and moulded pieces, which were particularly suited for mass production. All the detail drawings were completed by February 10, 1940. There were only 2500 drawings, thank to the simplification created by the use of moulded parts.

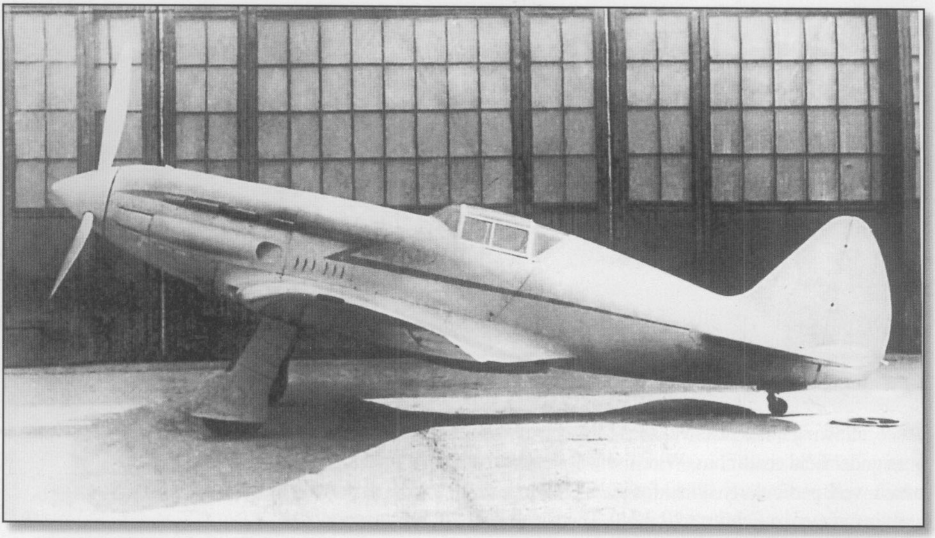
As with many other Soviet fighters of the time, the I-200 was made partially of plywood; this led to a higher weight than aluminium alloy structures, but reduced the need for scarce strategic materials. The rear fuselage and the outer parts of the wing were similarly constructed. The mid and aft fuselage was made with a structure of welded steel tubes, covered with aluminium alloy panels fixed by Dzus-type fasteners. The central part of the wing was made of aluminium alloys, integral with the fuselage; the control surfaces were an aluminium alloy frame covered with fabric.

Thanks to a great effort from his bureau, the I-200 prototype was completed on March 31, 1940. Then it was critically examined by A.G.Brunov, senior test pilot of Zavod 1 and leading engineer for the tests, and by Colonel M.I. Martseliuk and Major M.N. Yakushin of the VVS.

The I-200 n.01 was first flown on April 5th, 1940, by test pilot A.N. Ekatov of Zavod 1. On the whole, the tests were satisfactory, though there was a fire in the inlet pipe due to a engine backfire on the 3rd flight, and some other difficulties: engine overheating, the canopy that was side hinged and impossible to open in flight, and there was insufficient braking power. On



I-200 the first prototype scale plan. 1/72 scale

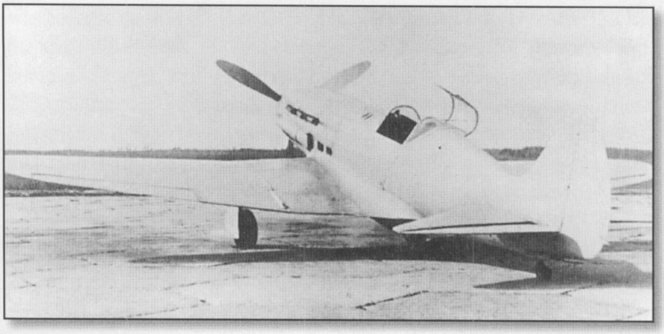


This photo shows the I-200 nr.1, characterized by the oil cooler on the left side only. The side cooler was modified several times, and eventually an oil cooler was added on the right too.

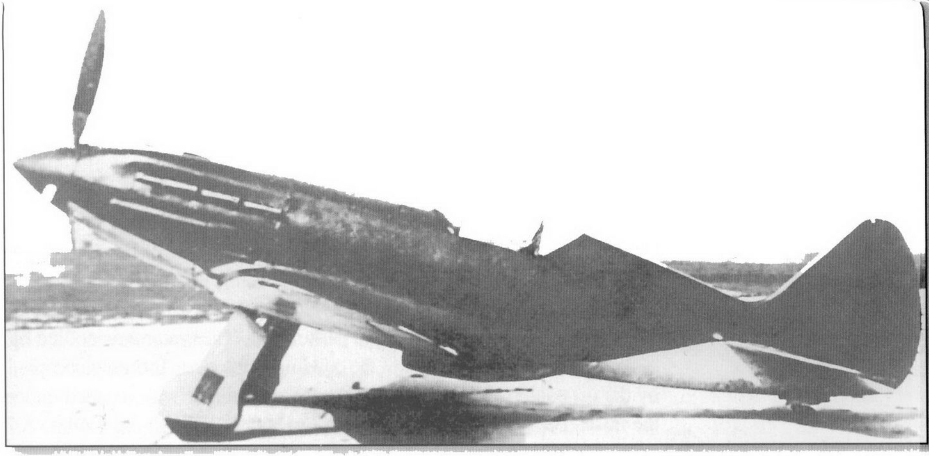
1st May 1940 Ekatov flew the I-200 n.01 over Moscow's Red Square. On May 24 it reached a speed of 648 km/h at a height of 6,900 m, an exceptional performance not just in the Soviet Union. The only faster production built aircraft of the time was the Heinkel He100.

The I-200 no.02 was completed for tests on April 25, and it was first flown by M.N. Yaskushin on May 9. It was externally distinguishable from the Nr.1 by the oil coolers on both sides and the by the presence of slots in front of the windshield. The I-200 no.03 began ground tests of the armament on May 13, 1940. The prototype was completed on June 1, and was flown on June 6 by M.I. Martselyuk. This prototype had metal outer panels on the wings, but this modification wasn't used on later aircraft. It was also equipped with radio.

The performance demonstrated during the tests was highly satisfactory, particularly concerning speed. The I-200 no.1, flown by Ekatov, reached 648.5 km/h at 6900 m in the nominal operating range of the engine on May 24. I-200 n.02 flown by Yakushin reached 651 km/h at 700 m, at nominal power



I-200 no.02 during tests at NII-VVS.



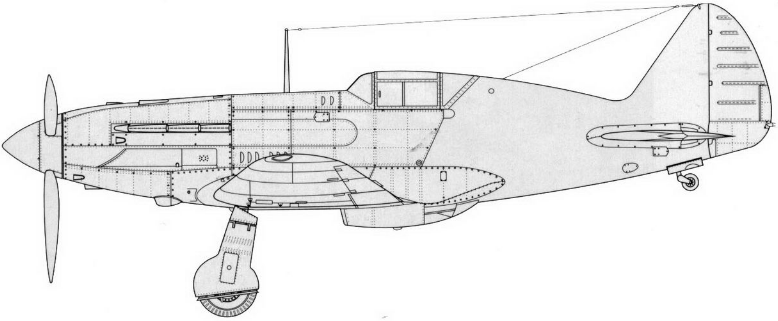
I-200 no.03 during tests at NII-VVS.

as well. It reached 579 km/h at 2220 m and 605 km/h at 3630 m. The fighter reached an altitude of 5,000 m in 5.1 min, and 7,000 m in 7.15 min.

On May 25, 1940, even before the tests were completed, the Committee for Defence and the NKAP ordered the I-200 into production at Zavod 1, where it replaced the BB-22. It was expected than 125 I-200s would be built by the end of 1940. Such hurry was influenced by the enthusiasm of Stalin for the display in Red Square on May 1, and from the results of the tests, but the design team knew it was an error. In fact, tests also showed that the aircraft was demanding to fly, as it was longitudinally unstable and had neutral lateral stability. A list of 112 defects and corrections was made, including:

- improve stability;
- protection for the centre section fuel tanks;
- install wing slats;
- enlarge the wheels to provide for an increase in weight;
- install 2 further removable machine guns;
- increase the fuel tank capacity to reach a range of 1000 km.

The I-200 was first shown to the public at the Tushino Air Show on August 18, 1940, where the I-200 no.03 flown by Yakushin made a demonstration flight. On September 13, 1940, at a meeting between the OKO and NII-VVS to discuss the results of tests, the chief test pilot Suprun commented



I-200 No. 3 scale plan. 1/72 scale.

NII-VVS to discuss the results of tests, the chief test pilot Suprun commented that "... the I-200 was the only prototype to pass the state tests at the first attempt"; by comparison, the I-26 (later Yak-1) and I-301 (later LaGG-1) had to repeat the state tests several times.

Modified I-200

I-200 with AM-37 engine

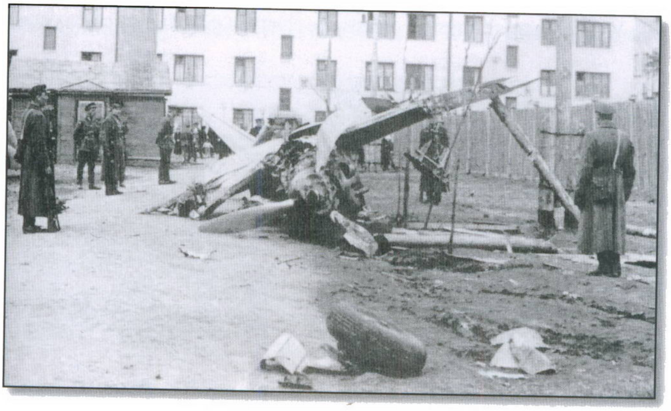
In late 1940, the AM-37 engine was reasonably close to being operational. It was the first engine on which the Project X was based, and was able to give about 200 hp more than the AM-35A.

The I-200 n.02 was refitted with this engine. There was a water intercooler between the supercharger and the carburettor. The water was cooled by radiators installed in the sides of the cowling in the place formerly occupied by the oil coolers; a new crescent-shaped oil radiator was installed under the nose. The propeller was a VISh-61AP, with wider chord blades. All armament was removed.

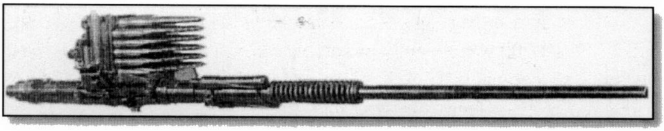
The aircraft was first flown by the test pilot A.I. Zhukov. During the tests, the engine performed poorly above an altitude of 4,000 m, so it was decided to send it back to Zavod no.24 to be further tuned. However, this was not sufficient, because on May 7 1941 test pilot I.T. Ivashenko crashed during landing due to an engine failure, and the aircraft was damaged beyond repair. An inquiry suggested that the accident was due to pilot error, attempting to switch the engine fuel flow from the wing root tanks that were empty to the fuselage tank at too late a point in the flight routine. Further experiments with the AM-37 engine were later made on a MiG-3.

IP-201

The IP-201 was an I-200 armed with 2 MP-3 (PTB-23) guns of 23 mm calibre, with 60 rounds each, and two 7.62 mm ShKAS, with 750 rounds each. The UBS 12.7 mm gun was removed to increase the fuselage tank capacity to 195 l. The MP-3 guns, designed by J.G. Taubin and M.N. Baburin of OKB-16 NKV, were installed in underwing pods. Two 100 kg bombs could also be carried. It was estimated that the speed would decrease by 10-15 km/h in comparison with the original I-200, but if the AM-37 engine could be



May 7 1941 test pilot I.T. Ivashenko, flying the I-200, crashed during landing due to an engine failure. Pilot survived the crash.



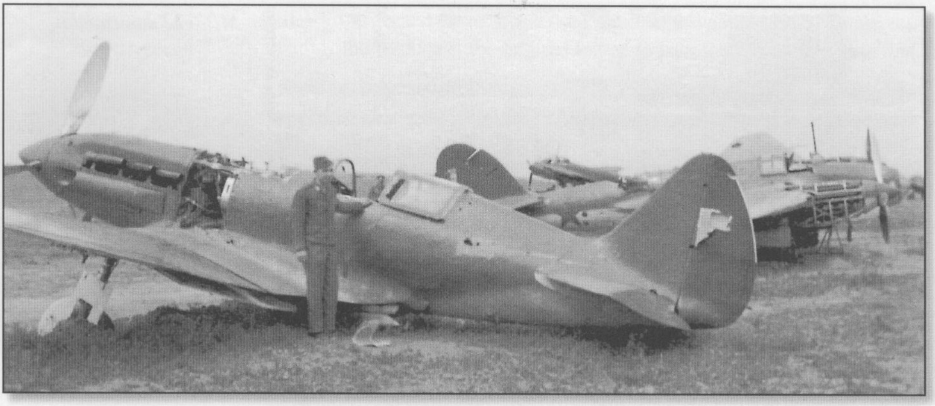
MP-6 23 mm cannon.

installed, it should remain about 650 km/h. The armament was tested on June 16, 1940 on a mock-up aircraft, and on 27 July a commission of the NKAP, headed by B.N.Yurev, approved it. It was noted that the maximum speed reduction was likely to be about 25 km/h, greater than was first estimated. The NII-VVS, stated on August 14 that the rate of fire of the MP-3 guns (300 rounds per minute) was unacceptably low, and proposed the installation of BS 12.7 mm guns with 300 rounds each instead. However, the modification of I-200 no.03 into the IP-201 was started during late September 1940, when the aircraft returned to Zavod 1 from performing state trials at NII-VVS.

On October 12, 1940, NKAP ordered NKV to study the possibility of placing MP-3 guns instead of ShKAS in the I-200's nose. OKB-16 received a mock-up aircraft, and studied the installation of the guns. The conclusion was that both the gun and the synchronizer needed significant modification. The installation of guns on the wings, however, didn't require as much modification. The mock-up aircraft, equipped with a gun on its left wing, was sent to NKAP on October 28.

The OKB-16 modified the MP-3 into the MP-6, able to fire 600 rounds per minute. This arrangement was approved by the NKAP and VVS, which ordered the main combat aircraft builders to develop underwing pods for the MP-6 23 mm gun and AP 12.7 mm gun, both designed by Taubin and Baburin.

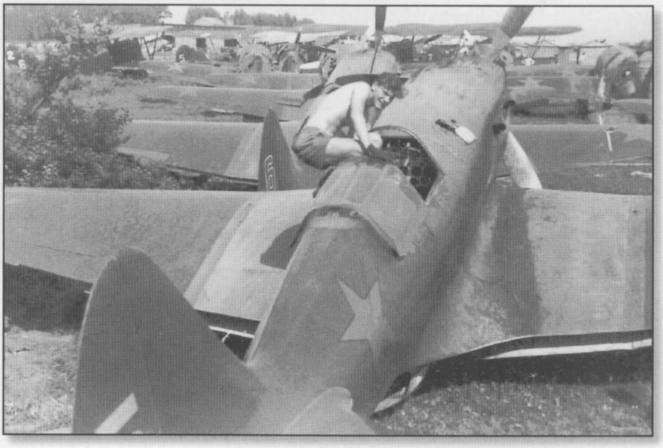
Work on I-200 no.03 was completed with strengthened and modified outer wing panels, with MP-6 guns, and the ShKAS replaced by 2 AP 12.7 mm machine guns. However, the guns caused visible flexing of the wings. The work was suspended to allow the I-200 no.03 to fly, alongside nos.01 and nos.02, in the Air Display of November 7 1940 above Red Square in Moscow. After this, the work on no.03 was started again and completed by the end of November. On December 1, 1940, test pilot V.N.Gurskiy flew the aircraft, but he had to make a forced landing, damaging the aircraft. On March 1941 factory tests started again. They soon ceased, because the MP-6 and AP guns failed to satisfy the high expectations for them, and they didn't enter service. Taubin and Baburin were shot for their failure.



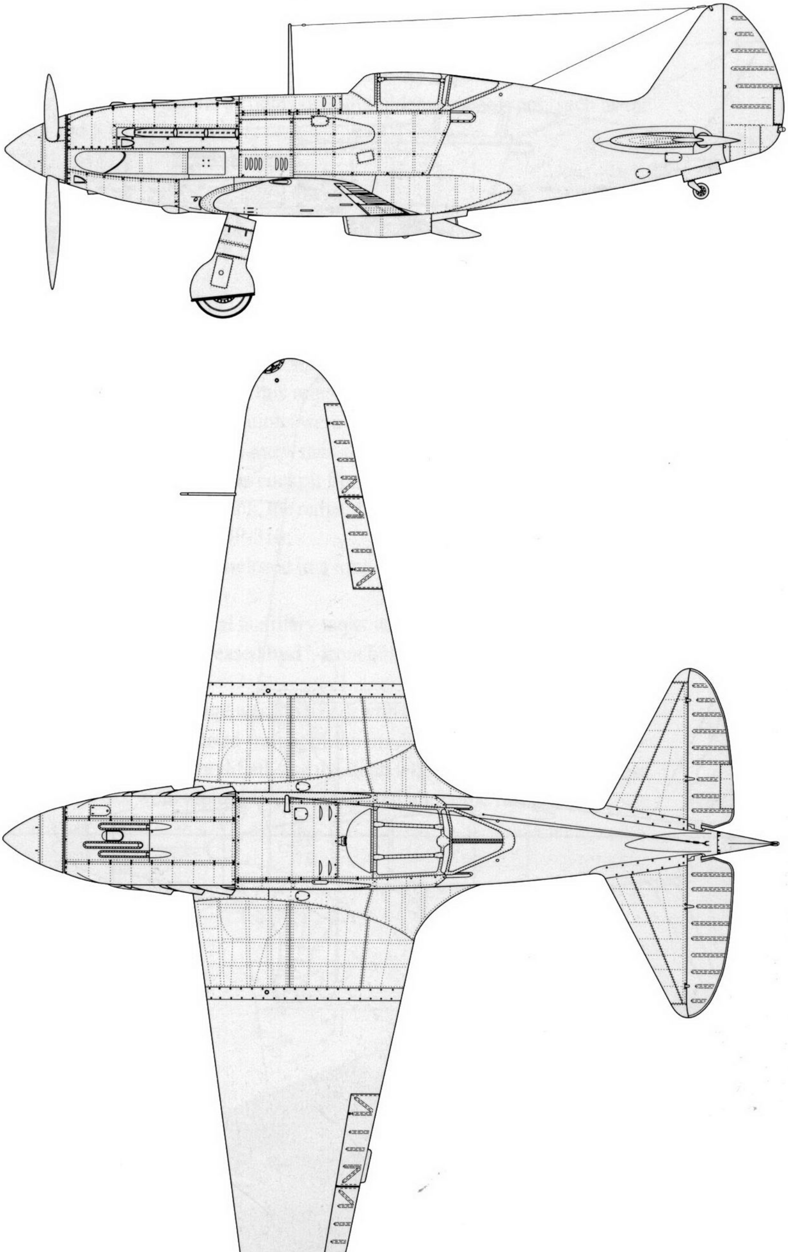
MiG-1 Series

Above photo of an operational MiG-1 captured by the Germans shows the shorter radiator and the different undercarriage covers from the MiG-3. Note the slightly shorter nose too, with exhaust stacks slightly overlapping the panel behind them, but in all other respects (sliding canopy etc.) this aircraft resembles an early MiG-3. Note the small red star with black outline on the fuselage. A piece of fabric has been removed from the rudder by some souvenir hunter; it possibly had a 7 painted on it.

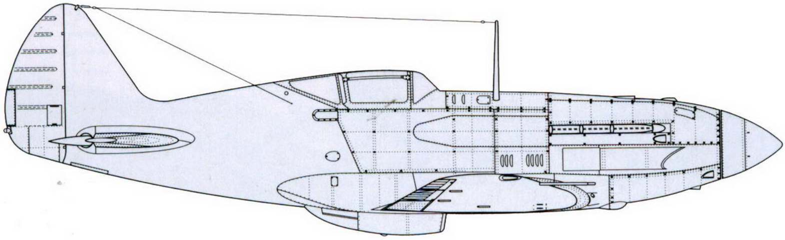
The aircraft was officially named MiG-1 in December 1940, this designation having been already unofficially used in the factory for the aircraft that was still officially named I-200. By the end of 1940, 100 MiG-1s had been built, and the first 20 of them were delivered to the VVS within the year, with the rest delivered in early 1941. The first operational units to receive the new aircraft were 31st IAP at Kaunas Air Base, in Lithuania, and 41st IAP at Białystok Air Base, in Soviet-occupied Poland. It was necessary to conduct tests of production aircraft under operational conditions. From December 1940 to February 1941, pilots and ground crew of 41th IAP conducted tests at the Kachinskaya Military School for Pilots, supervised by the test pilot Suprun. Before these tests, the retraining of crew was taken in charge by NII VVS, which started with the pilots of 146th IAP. It is not clear if all the aircraft were at this point equipped with the rearward-sliding canopy (as on later MiG-3s), or if some of them had still a hinged canopy as with the prototypes. Some profiles of MiG-1s with a prototype-style canopy are seen in print, but no photo is known. Pre-war photos of production MiG-1s are extremely rare, if any exist at all. Sadly, the few photos available of this

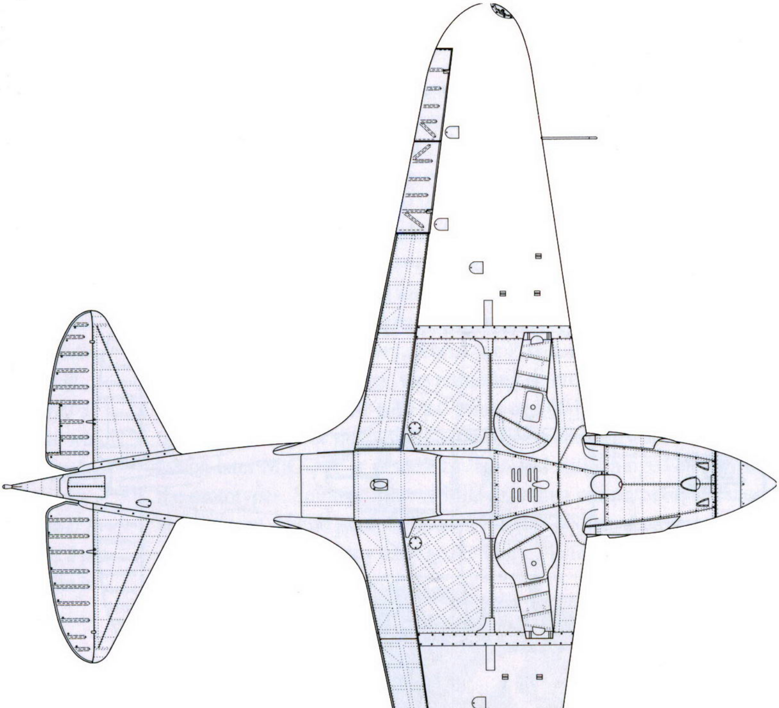


Bottom photo shows some operational MiG-1s captured by the Germans. They belonged to 31 IAP based at Kaunas air base. Another unit to receive the MiG-1 was 41 IAP based at the former Polish airport of Białystok.



MiG-1 .
1/72 scale.





MiG-1 .
1/72 scale.

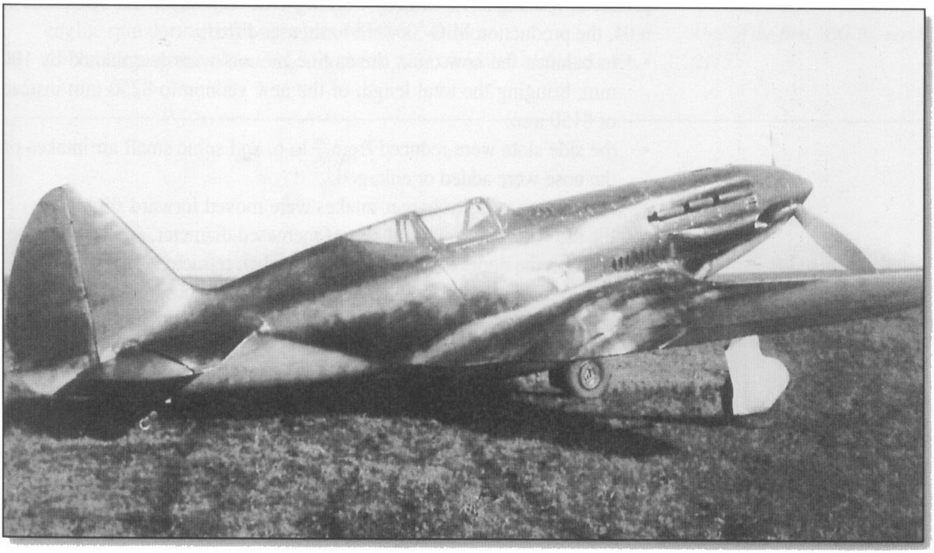
type are of German origin, and represent wrecked or captured aircraft, often vandalized by souvenir-hunting Germans.

Large numbers of MiGs were captured because most Soviet pilots were not comfortable with the new MiG's tricky flight characteristics, and preferred to evacuate the airfields or fly in older combat types, such as the I-153 and I-16.

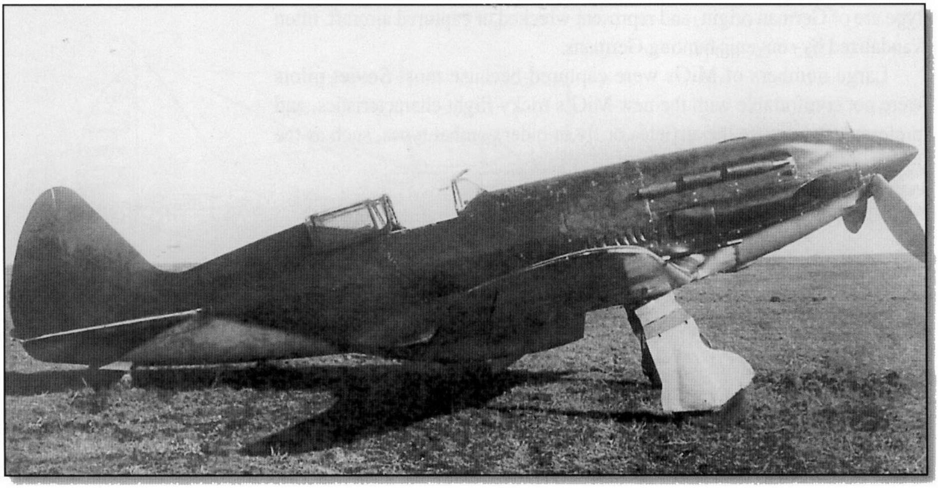
From MiG-1 to MiG-3

The SKF resolution of October 2, 1940, required an increase in the range of new fighters to 1,000 km, at 90% of maximum speed, measured with fuel contained in internal tanks only. So Zavod 1 was ordered to develop a new version of the I-200 that met this request. To increase range and to remedy other defects, some modifications were made to the original series I-200:

- to increase fuel capacity, a new tank with a capacity of 250 l was installed in the fuselage below the cockpit floor;
- to make room for this tank, the radiator was moved forword and replaced with a larger one, an OP-310;
- both structures were enclosed in a long cowling called karakatitsa (cuttlefish);
- the fittings for external auxiliary tanks were deleted to save weight;
- the dihedral was increased by 1^0, from 6^0 to 7^0, to increase lateral stability;
- the main undercarriage was modified, with new wheels of 650 x 200 mm to support the increased weight of the machine;
- the u/c doors were modified, and the small wheel shields, similar to those of the I-16, were replaced by doors hinged under the fuselage;



I-200 no. 4 prototype.



I-200 no. 4 prototype.

- the u/c doors were modified, and the small wheel shields, similar to those of the I-16, were replaced by doors hinged under the fuselage;
- the fuel tanks were self-sealing.

The prototype of the new version was the I-200 no.04, ready for factory tests on October 21 It flew on October 29, 1940, flown by A.N. Ekatov. At the end of November the aircraft was sent to the south to escape bad winter weather, to continue testing with NII-VVS. No.04 had the same nose configuration as the production I-200 (MiG-1), and was 8150 mm long.

The older version was officially named MiG-1, and the new version MiG-3, according to an order from NKAP of December 9. The MiG-3 was put into production on 20 December 1940, starting with machine number 2101 (101st series aircraft). The modifications created some problems on the production line that was already working at its full rate. When compared to n.04, the production MiG-3s were further modified:

- to balance the new tank, the engine mounts were lengthened by 100 mm, bringing the total length of the new version to 8250 mm instead of 8150 mm;
- the side slots were reduced from 7 to 6, and some small air intakes on the nose were added or enlarged;
- the wing root supercharger intakes were moved forward slightly;
- the tail wheel was now rubber, of increased diameter, and this required a slot in the doors to allow it protrude when retracted.

It was decided to build 3500 MiG-3s in Zavod 1 during 1941, and to start production in Kiev, where it was projected to build 100 further MiG-3s during 1941. This second production line was never started. After 100 MiG-1s built up to mid December 1940, Zavod 1 Moscow-Vnukovo produced 20 MiG-3s in late December 1940, and 150 MiG-3s in January 1941. During February production increased, and in March it 1941 it reached a rate of 70 per week. By March 28, 473 MiG-3s had been built, of which 270 were already sent to operational units. At that time, production of this new version of the fighter at Zavod No.21 in Gorkiy (now Nizhniy Novgorod) and at Zavod no.43 in

Kiev was considered, but this idea was soon abandoned. Aviation repair depots in Riga were adapted for MiG-3 maintenance.

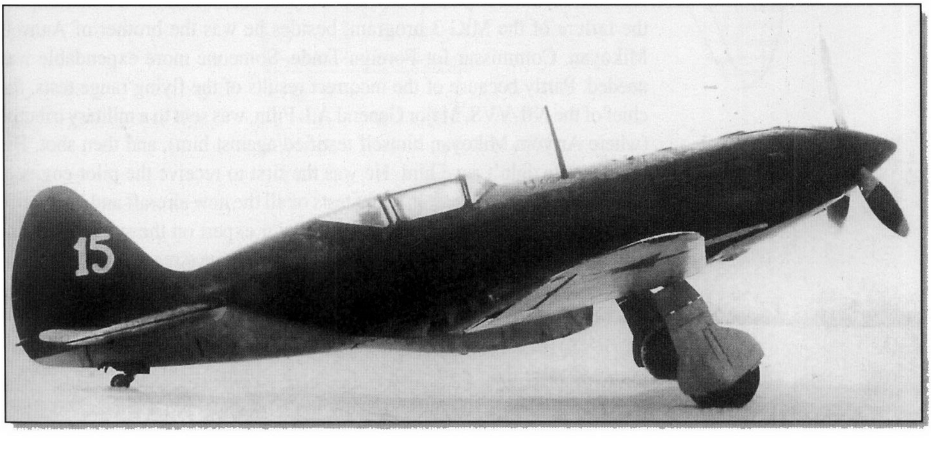
This hurry to build new fighters and to re-equip operational units was due to fears about the coming war, but it caused a deterioration in production quality. MiG-3s built in this period were slower and rougher than the prototypes, and prone to many faults. Besides, many of the required improvements were not introduced quickly into production.

The state tests

The tests on I-200 no.04 were never completed. Two production MiG-3s, n.2107 and 2115, were employed for state tests from January 27 to February 26, 1941, flown by pilots Captain A.G. Proshakov and A.G. Kochetklov.

These tests were intended to compare the new version with the older MiG-1, to detect defects, to judge stability and spinning properties and to determine flight performance. Results:

- the mass of the aircraft was increased from 3100 kg (of the MiG-1) to 3355 kg;
- the horizontal speed was the same;
- the rate of climb deteriorated, requiring 1.71 min more to reach 8000 m;
- spin characteristics were the same as the I-200, in fact the aircraft could recover from a spin after two turns;
- being unstable and with high aileron loads, the aircraft rapidly tired the pilots;
- the armament worked reliably;
- the range of the RSI-3 radio was 150 km;
- it was noted that the VISh-22 propeller was inadequate, because the insufficient angle of the blades (20^0) caused a dangerous increase in engine rpm during dives at angles of 50-60^0 or more;
- the throttle response of the AM-35A engine was considered inadequate too.

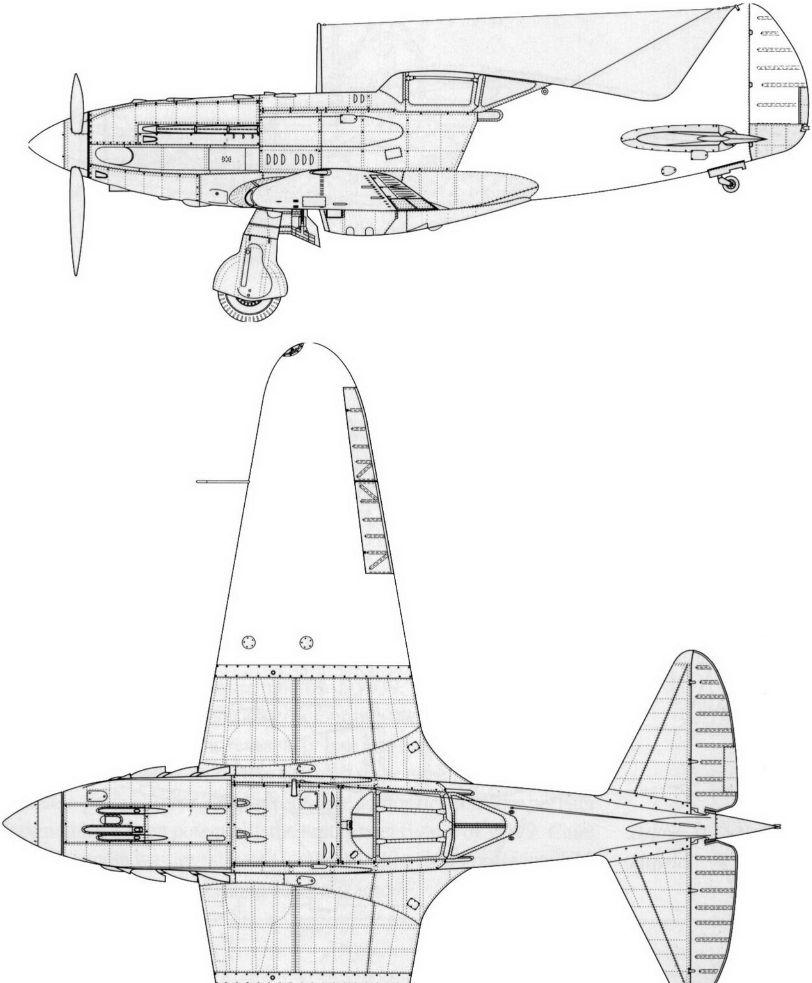


One of the first MiG-3s, serial 2115.

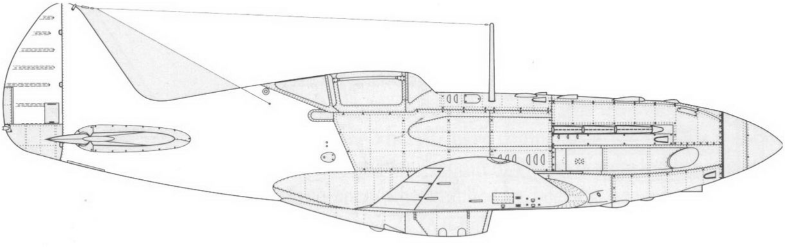
The range of the MiG-3 was checked using the route Chvalovsk-Seym-Chkalowsk-Moscow (Central Airfield), for a total of 710 km, with a speed of 574 km/h (90% of top speed) at an altitude of 8,000 m, with the engine at 1950 rpm. On 22 February 1941 MiG-3 n.2115 was refuelled with 463 kg of fuel at take off; on landing, there remained 84 kg in its tanks, of which 34 were not usable because of design defects. This led to a calculation of the range at 820 km. MiG-3 n.2107 gave comparable results. This was obviously less than the 1000 km range required. The tests were made without the altimetric fuel ratio compensator switched on, because, according to the engine manual released by Zavod 21 that built the Mikulin engine, this could not be used at an altitude of 8,000 m. The factory technicians, however, disagreed with this limitation. Mikoyan decided, with the agreement of the engine designer A.Mikulin, that the altimetric compensator should be used for the tests. On April 4, the chief designer A.I. Mikoyan and his assistant M.I. Gurevich wrote to the People's Commissar of the Aircraft Industry, A.I. Shakhurin, that they had calculated reliably a range of no less than 1000 km, on the basis of a fuel consumption of 0.38 kg/km. It had reached 0.48 kg/km during state tests, because the altimetric compensator had not been used during the NII-VVS tests, causing an increase of fuel consumption. Tests conducted on April 19 by Zavod 1 on two production aircraft confirmed the results of the calculation, giving a flight range of 1180 km.

Tribunals and scapegoats

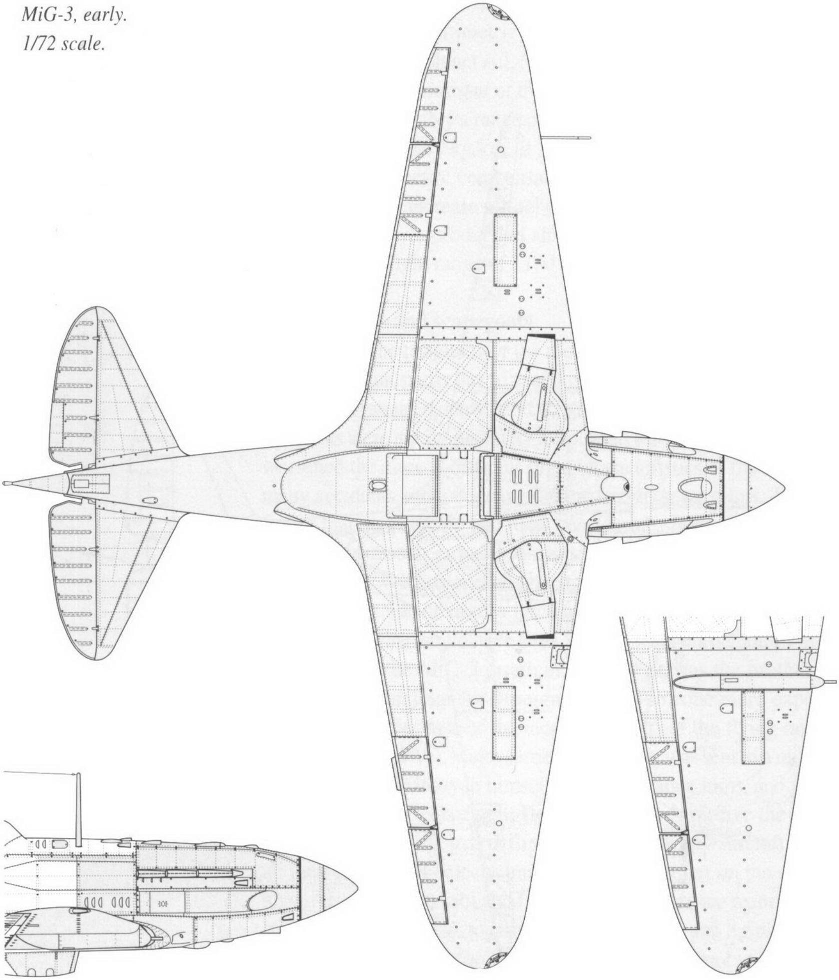
Overall, the program for the modernization of the fighter force ran into many problems, partly due to excessive hurry. The aircraft delivered to operational units revealed many defects, while the improvements suggested by the test pilots were not immediately introduced into production. All these factors worsened the already difficult flight characteristics of the machine, causing many accidents and a wide opposition to it by most pilots. The government feared that the program had to be considered a failure. This meant not only that a lot of resources had been wasted, and that great hopes were dashed, but that the VVS fighter modernization would be delayed for many months, while the war was obviously imminent. Some scapegoats were needed. The most obvious one would have been Mikoyan, but his demotion would expose the failure of the MiG-3 program; besides he was the brother of Anastas Mikoyan, Commissar for Foreign Trade. Someone more expendable was needed. Partly because of the incorrect results of the flying range tests, the chief of the NII-VVS, Major General A.I. Filin, was sent to a military tribunal (where Artyom Mikoyan himself testified against him), and then shot. His great merits didn't save him. He was the first to receive the pilot-engineer qualification, he took part in flight tests of all the new aircraft and knew well all their merits and defects, and was a major expert on the subject of spinning. Also, he had established a new flight endurance record of 75 hours in a Tupolev ANT-25RD, together with M.Gromov and I. Spirin. He had been chief of the NII-VVS for 3 years. Additionally, many section chiefs of the NII-VVS, such as A. Voydevodin, P. Nikitchenko and M.Maksimov, were removed from their posts. All of them were unjustifiably accused of sabotage and hindering the introduction of new aircraft. Even N.N. Polikarpov



MiG-3, early .
1/72 scale.

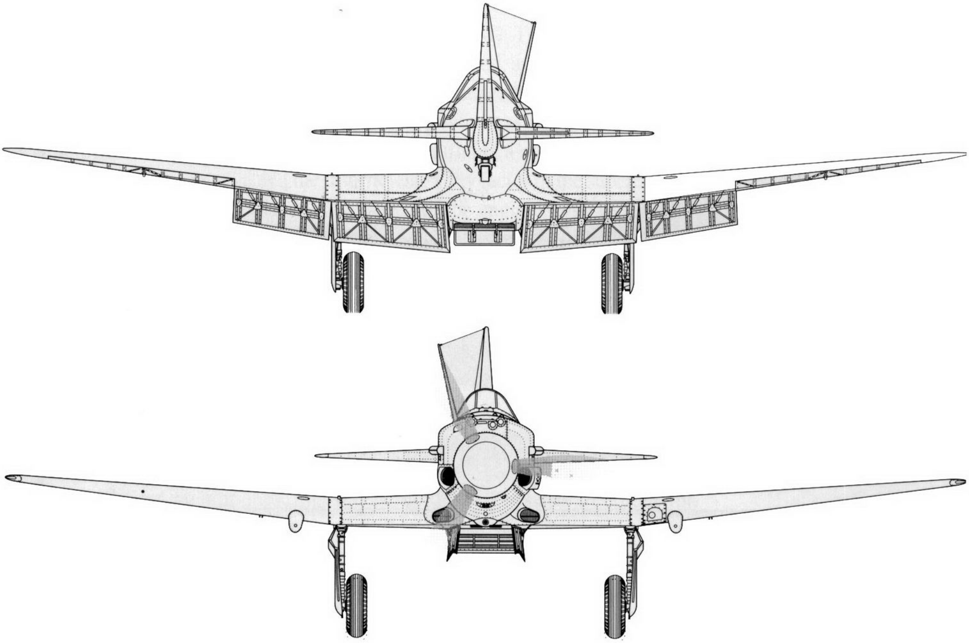


MiG-3, early.
1/72 scale.



MiG-3, early with gun pods.
1/72 scale.

MiG-3, early with gun pods.
1/72 scale.

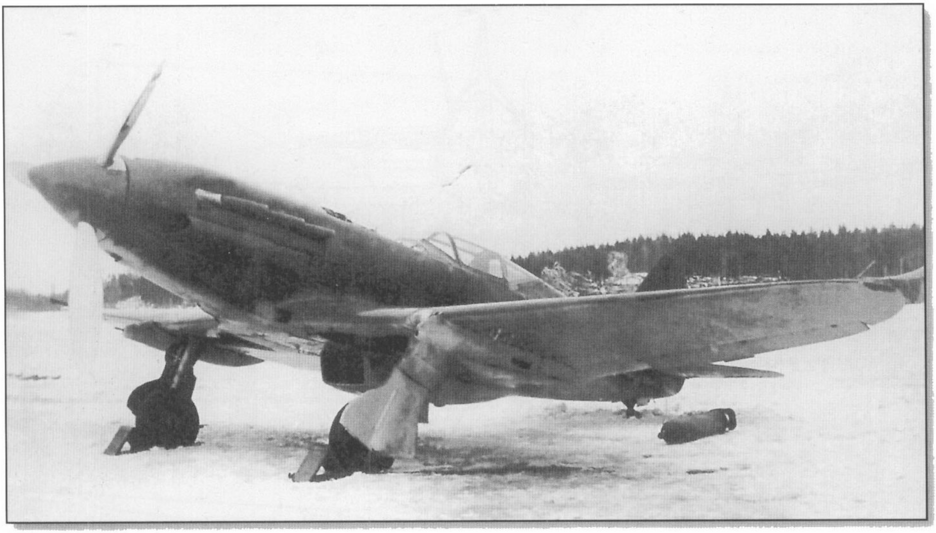


MiG-3, early with gun pods. 1/72 scale.

tage and hindering the introduction of new aircraft. Even N.N. Polikarpov came under investigation, because Project X had been his own, and he had delayed its promised start by some months in 1939. Although he was not prosecuted, this investigation contributed, alongside the I-180's failure, to his total loss of influence, and to the removal of him and his team from Moscow to Novosibirsk, where he continued to work on some excellent projects that did not result in production orders. Indeed some authorities consider his later I-185 design to have been potentially the best Soviet fighter of WW2. Chief Designer V.Romodin was investigated too, and, although not prosecuted, he was transferred to Novosibirsk alongside Polikarpov.

***Below**: MiG-3 at the Central airfield.*

via V. Kulikov



A still unmarked MiG-3 no.2371 with gun pods. The object on the ground is a compressed air bottle; inner u/c wheels doors have been closed by hand for photographic or maintenance purposes.

Production of the upgunned MiG-3

The standard armament of the MiG-1 and of early MiG-3s was composed of one 12.7 mm UBS gun and two 7.62 mm ShKAS guns, all in the nose. From February 20, 1941, a new version with two further 12.7 mm UBK guns in under-wing pods with 145 rounds each entered production. This modification proved to be unsatisfactory, as the weight increased by about 150 kg, causing significant deterioration of the flight characteristics. Besides, firing during high g manoeuvres was inaccurate due to torsion flexing of the wings, so most of the gun pods were removed when the aircraft arrived at front line units. In total 821 examples with 5 guns were produced through July 27, 1941, when the under-wing guns were deleted from production, and the armament returned to the original standard. The fixtures for under-wing gun pods (i.e., rectangular ammunition access panels visible under the wings) seems to have been retained on subsequent aircraft, and to have been removed only towards the end of MiG-3 production

Accidents during tests and introduction into service

On 12 January,1941, the test pilot V.Kuleshov entered into a spin and, although he tried to save his aircraft, he crashed and was killed. Another test pilot, N.Baulin, suggested that new monoplanes should be piloted differently from biplanes, as overcorrection of the control column during loops caused spins. Another test pilot, V.Gursky, had to make seven emergency landings in four days of tests, and in two cases he came close to disaster.

The aircraft was difficult to master even for experienced test pilots, so it created major problems for the typical Soviet pilot of early 1941, whose training was not so advanced. Many accidents happened during the introduction of the new type. One of the first units to receive the MiG was 16th IAP of the Moscow Air Defence, that assigned them to experienced pilots. In March, the best pilots of 34th IAP visited Zavod 1 and were trained to fly MiG-3s; by

Three days before, a pilot was killed in an accident. On March 13, the oldest test pilot A.N.Ekatov died while testing MiG-3 n.2147. This happened during a test to determine the rate of climb, maximum speed, and fuel consumption at high altitude. Investigations showed that the supercharger had exploded, damaging the aircraft and hitting the pilot, who was unconscious at the moment of impact with the ground. The aircraft dug a crater nearly ten feet deep. This accident revealed the insufficient safety factor of the supercharger impeller. It was 26% at the nominal speed of the engine (2050 rpm), but it reduced to only 6% at the maximum speed of 2350 rpm. Besides, the material of the impeller (alloy AK-1) was prone to metal fatigue.

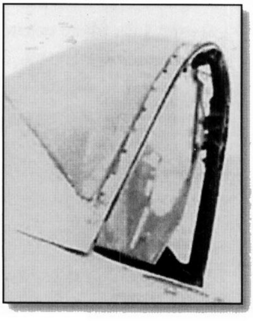
Modifications to the MiG-3 series

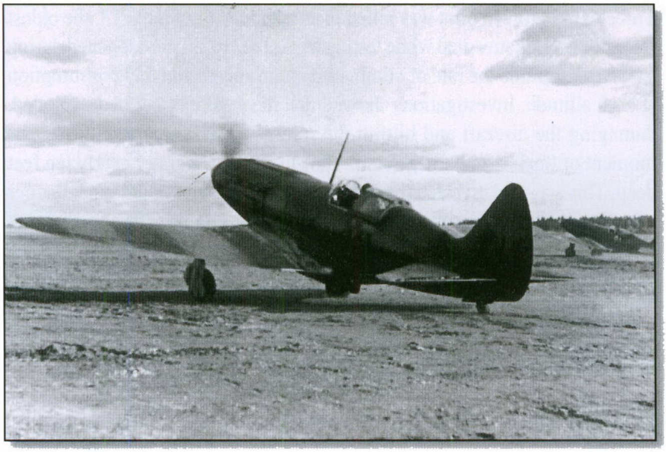
The aircraft built during the spring of 1941 were 30 km/h slower than the initial production ones; this was partly due to the haste in production leading to poor surface finish, partly to the presence of underwing gun pods, introduced in February. Many defects were noted during operational use, alongside the already known weak armament, tendency to spin, longitudinal instability and high landing speed:

- sliding canopy difficult to open at speeds over 400 km/h, and this led pilots to usually fly with the canopy open, reducing speed by 30 km/h;
- landing gear often failed to extend, and was easy to damage during landing;
- it was difficulty to repair damage to the carburettor duct after a belly landing; this could ground the aircraft for a long time;
- it was difficult to repair internal structures in the rear fuselage, because the horizontal stabiliser was integral with the fuselage and limited access;
- unsatisfactory view, particularly during takeoff and landing, due to the long nose and marked nose-up stance on the ground;
- oil leakage onto the windscreen reduced visibility;
- high cockpit temperature, due to the ventral radiator;
- exhaust fumes and fuel vapour in the cockpit;
- lack of a fuel flow indicator;
- low range, particularly with canopy open, that reduced its utility as a reconnaissance plane;
- unsatisfactory engine acceleration that caused accidents;
- drop in oil pressure while diving with a negative g load.

The MiG-3 was conceived as a high altitude fighter, but its fuel pump was not suited for the job, starving the engine even at 5,000 m altitude. An attempted interception of a high-altitude German reconnaissance plane was made by three MiGs of 31st IAP, based at Kaunas airport in Lithuania, on April 10, 1941, before the official beginning of the war. It was a failure, because all three interceptors entered into a spin during the combat and were lost, killing one pilot. Pilot engineer A.Kochetkov went to Kaunas to investigate. He found that the pilots' training was insufficient, particularly

Armoured glass was occasionally installed inside the windshield.

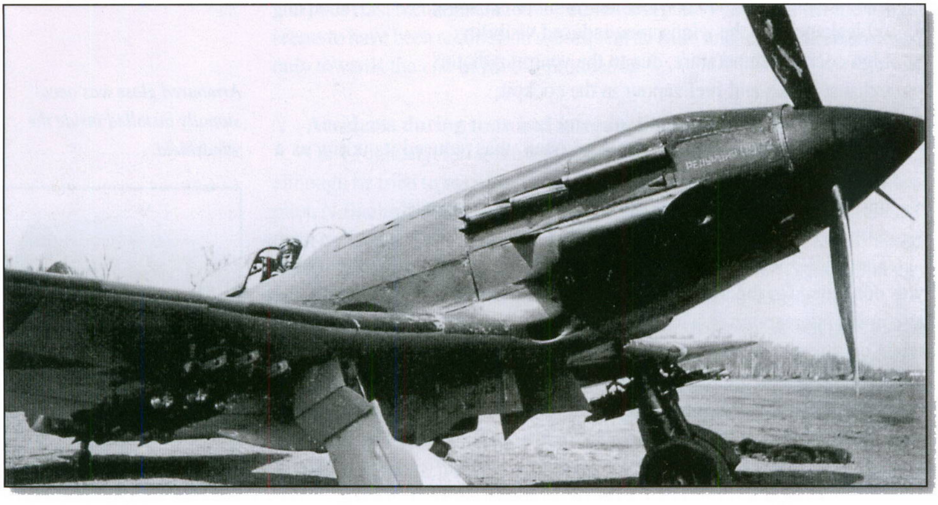


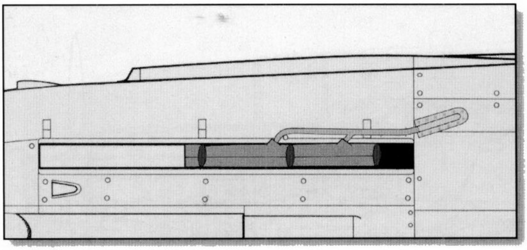


MiG-3 (red "40") Baltic Fleet Naval Aviation, 1941. via V. Kulikov

investigate. He found that the pilots' training was insufficient, particularly for high altitude operations. So he organised some tests, and discovered that, if well piloted, the aircraft was able to make combat turns without spinning up to an altitude of 10,500 m. He recommended retrofitting an automatic mixture control on the carburettor, modifying the oil and fuel pumps to avoid loss of pressure at high altitude, and installation of reliable oxygen equipment. These recommendations were soon implemented, and pilots of 4th IAP and 55th IAP, based near the Romanian border, shot down three hostile aircraft. Pilots of this unit were helped in training by test pilots. At the beginning, these units had both old fighters (I-153s, I-16s) and MiG-3s. No-one wanted to fly the MiG, until test pilot P. Stefanovsky made some demonstration flights that changed the minds of the pilots, who then started to train on the new machine. The 55th IAP was the unit of the future top ace A. Pokryshkin, who was impressed by the new fighter, particularly for its capability in vertical manoeuvres.

This interesting photo shows n. 5015 produced in late 1941, armed with two UBS machine guns and two racks for ROS -82 rocket projectiles.





A system to fill tanks with inert gas was installed; this is recognizable from a small pipe taking exhaust gases from the 2nd and 3rd exhaust stacks on the left side only.

The request for a 1000 km range penalized the MiG-3 and LaGG-3, increasing their weight; in contrast, the Yak-1 never satisfied it, so its flight characteristics were not impeded by extra weight. In 1941, the only fighter from the Yakovlev OKB that achieved this requirement was the I-30, that never progressed beyond a prototype. From May 10, 1941, the ventral tank was reduced from 250 l to 140 l to save weight. Tests on aircraft n. 2859 (with 5 guns) showed that this improved takeoff, landing, turning and horizontal stability. The time for a full turn was reduced by 2-3 s.

From July 10, 1941, automatic slats were introduced, noticeably improving the flight characteristics with regards to spinning.

In the second half of 1941 the engine reduction gear ratio changed from 0.902 to 0.732, and this was associated with a new AV-5L-123 propeller instead of the VISh-22E. The new propeller blades had a pitch angle range of 30^0 instead of 20^0. The two props are not distinguishable in photos. Late MiG-3s could have either gear ratio; the installed one was painted on the cowling side to avoid mistakes when mounting the propeller.

A system to fill the fuel tanks with inert gas was installed. This is recognizable by a small pipe taking exhaust gases from the 2nd and 3rd exhaust stacks on the port side only. The purpose of this system was to exclude air from the fuel tanks, with obvious safety benefits. This system, although required by early test pilots since 1940, was only installed on aircraft built in summer 1941 and later.

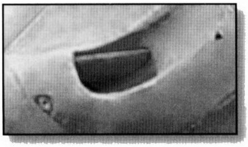
On April 12, 1941, the NKAP order n.322 demanded an increase in the daily production of the MiG-3 to 20 examples, starting from August; this increased the projected output of MiG-3s during 1941 to 4295 aircraft. In May 1941, the tail control surfaces were modified by an enlarged elevator (37% of total area), recognizable by the curved division line between stabilizator and elevator. These modifications were tested on 5 planes (nr.3205, 3211, 3214, 3120 and 3169) and approved.

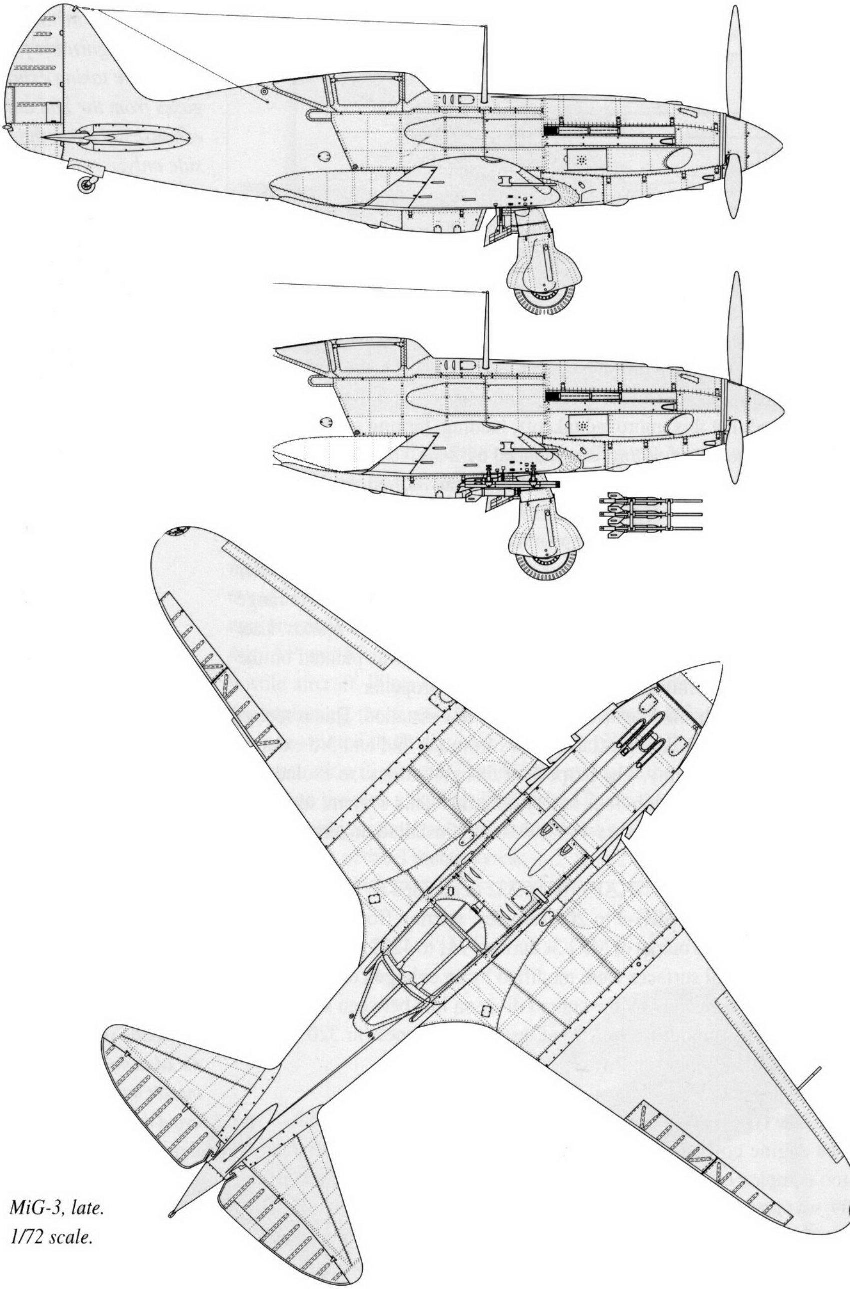
The late type MiG-3 appears

The engine cowling with Dzus locks was considered unsatisfactory and too complex by first line units. A new cowling, inspired by that of the Bf109, was tested at first on aircraft n.2554, and then introduced into series production from the 16th series. (Each series was usually composed of 100 aircraft, so the new cowling was installed from aircraft n.3600, n.2001 being the first production MiG-1).

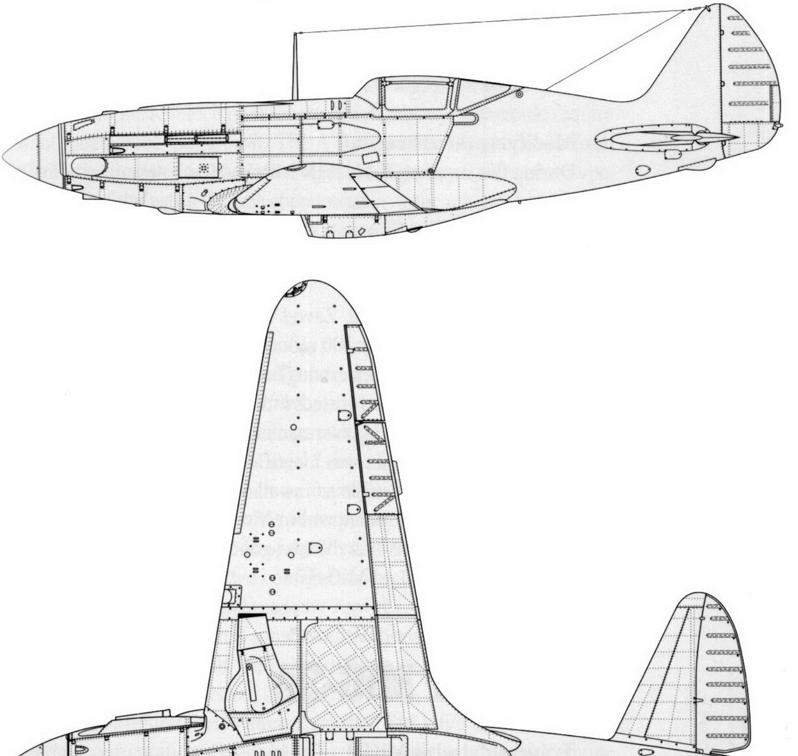
On many later examples, first observed during the winter of 1941/42, the tail wheel was fixed in the lowered position, while the doors were removed

Automatic shutters were introduced in the supercharger intakes on the wing roots to avoid dust ingestion; they were hinged on their upper side and opened rotating rearwards and upwards.



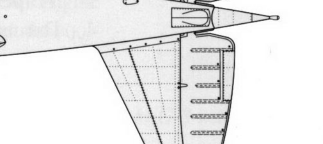


MiG-3, late.
1/72 scale.



MiG-3, late 1/72 scale.

MiG-3, late with mechanical engine starter.
1/72 scale.



and replaced by a canvas cover. It is not clear if this was change made in the factory or at unit level.

On some late MiG-3s, a Hucks starter dog was introduced, protruding from the tip of the spinner.

Modifying the armament

During the summer 1941, tests were made on several armament combinations:

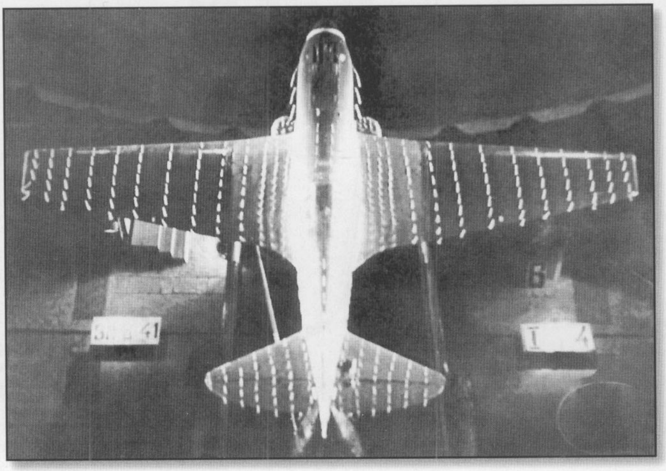
- 2 UBS and 2 ShKAS;
- 2 UBS and 1 ShKAS;
- 2 UBS.

Then, from September 20, Zavod 1 produced 315 MiG-3s armed with two 12.7 mm UBS guns with 700 rounds each; of these, 215 examples were armed with two ZROB-82 underwing batteries with 3 ROS-82 rockets each. Some earlier MiG-3s were refitted with rocket launchers too. Studies for arming the MiG-3s with a 2 gun armament were made from the end of 1940, and the 20 mm ShVAK gun was identified as the most promising; but, due to the war, it was not possible to install such armament in 1940. The last 52 MiG-3s, built in Kuibyshev and in Moscow, were armed with a pair of ShVAK cannon. It seems that the two-gun MiGs retained all 3 gun slots in the cowling, as on standard MiG-3s.

Modified MiG-3s

Trapezoidal wing MiG-3

During August 1941, TsAGI proposed the installation of trapezoidal wingtips on the MiG-3, that, according to wind tunnel tests, should decrease the landing speed of about 5 km/h. This modification was rejected, because such a small improvement couldn't justify disruption of the assembly line.



The photo shows a mock-up with trapezoidal wingtips in the T-101 wind tunnel.

MiG-7 (izdelye 72)

During April 1941, the AM-37 engine was approved for series production. A MiG-3 equipped with an AM-37 engine was built and named MiG-7. Test pilot N.P.Baulin and chief engineer V.N.Sorokin were assigned to its factory tests. The first flights revealed poor longitudinal stability, that would require significant redesign of the aircraft. The AM-37 engine was removed from the MiG-7 to be installed on the DIS-200 (MiG-5) heavy fighter prototype. The beginning of the war led to the abandonment of the project, because the priority of AM-38F production for Il-2s stopped production of the related AM-37.

MiG-3 AM-38

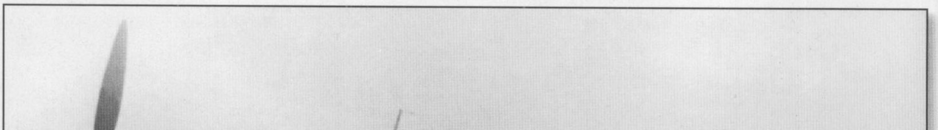
One weak point of the MiG-3 was its poor performance at low altitudes, where most air combat took place. To remedy to this, aircraft n.3595 was equipped with an AM-38F engine with a take-off power of 1600 hp and a AV-5L-110A propeller. The aircraft made its maiden flight on July 31, 1941, and tests were conducted for the following 12 days. Test pilots Y.K. Stankevich and chief engineer K.N. Mkrtychan were assigned to the test program. The greater power improved the aircraft's performance significantly, particularly maximum speed, up to an altitude of 4,000 m.

The aircraft was tested in two configurations:

- the first one was the original made by Zavod 1;
- the second one incorporated some modifications proposed by the chief designer: a new design of the exhaust stacks fairings, bomb shackles removed and inert gas system installed.

In the first configuration the aircraft reached 582 km/h at 3400 m, while in the second configuration it reached 592 km/h. While the AM-38 F engine could easily replace the AM-35A without structural modifications, the cooling system proved to be insufficient for this more powerful engine, and this limited the operation of the aircraft to temperatures not higher than 16^{0}C on the ground. After the tests in NII, the aircraft returned to Zavod 1 for modi-

MiG-3 with AM-38 engine.



fications, but after this the aircraft gave problems with the supercharger, and during a flight the aircraft suffered deformation of the fuel tanks. After 22 flights, on September 22 the aircraft returned to the factory for repairs. On October 4 the aircraft flew again on the airstrip of Zavod 1, but the following day the aircraft crashed, killing the test pilot N.P.Baulin. An investigation showed that the cause of this was combat with an enemy aircraft. Due to the shortage of AM-35A engines, some units conducted their own experiment with the AM-38. Two aircraft of 402 IAP were modified during November 1941, and were tested by the regimental Commander Major K.A.Grudzev, and squadron commander captain B.G. Boroday. The former shot down two enemy bombers while testing modified aircraft n. 4184.

Photo-reconnaissance MiG-3 During July 1941, five aircraft were modified in Zavod 1 with the installation of an AFA-I camera.

Lightened MiG-3 In 1943, two MiG-3s were modified by NII-VVS to increase their ceiling. One of the aircraft was lightened by 187 kg, down to a loaded weight of 3098 kg. Its ceiling increased to 11750 m.

Pressurized MiG-3 (project XS) Before the war, a pressurized cockpit was required for the I-200 and I-153. The chief designer of Zavod 482, A.Y. Tserbakov, developed three types of pressurized cabin. With the outbreak of war, the project was abandoned.

MiG-3 SPB for Zveno The SPB composite dive bomber, also known as Zveno, consisted of a TB-3 carrier aircraft with two modified I-16s armed with two 250 kg bombs each. The fighters were carried by the TB-3, released for the final attack, and then returned on their own. This allowed attacks on targets far beyond the range of normal bombers. An updated Zveno project considered the use of a Pe-8 four-engine bomber and two MiG-3s carrying bombs. The project was abandoned due to the heavy workload of the factories. Estimated data: total weight 33500 kg; maximum speed with all engines running: 405-420 km/h; Ceiling 8700-8900 m; Flying range at 5,000 m: 1320-1450 km, with the fighters' engines fed from the carrier's tanks; duration of flight about 5 hours.

MiG-3 with additional wing In 1941, designer A.A. Senkov proposed the installation of an additional retractable canvas wing on MiG-3s to reduce the landing speed. The proposal was not accepted because the increased weight and drag would reduce performance.

Moving to Kuybyshev

By the order NKAP n.648 of July 9, 1941, it was decided to open a second production line at Kuibishev in the Urals, 885 km east of Moscow, in a factory still to be built called Zavod 122. Kuibishev was selected as a military industrial centre for many other factories. On July 22 it was decided to move the factories eastwards to protect them from invasion and air raids. It was decided to transfer all the equipment and personnel from Zavod 1 as soon as possible. To begin with, part of the Mikoyan design team was transferred there during August 1941. The documents and drawings were transported by aircraft, but unfortunately heavy rain started during the unloading, and Mikoyan himself had to try to save papers from the rain.

During October, a factory airfield was prepared, many workshops were built, and a forge and a foundry were completed. Movement of the MiG-3 production line started in October 1941. The move was made efficently, so machinery in Moscow worked right up until the time it was to be dismantled, was moved eastward and quickly reinstalled into often unfinished workshops. Conditions were difficult, because buildings and infrastructure were lacking, and production often had to be started in unfinished workshops. Personnel were forced to move away from their homes and families to places where food, housing and clothing were lacking. The autumn weather was rainy, while winter brought cold (-35°C), snow, and ice. The first MiG-3 assembled at Kuibishev rolled out of the workshop ten days after the arrival of the last parts load, and production rate was 1-2 aircraft per day, well below the 10-15 aircraft per day in the original factory. All the MiG-3s made in Kuibishev (about 30) were built by assembling parts already manufactured in Moscow.

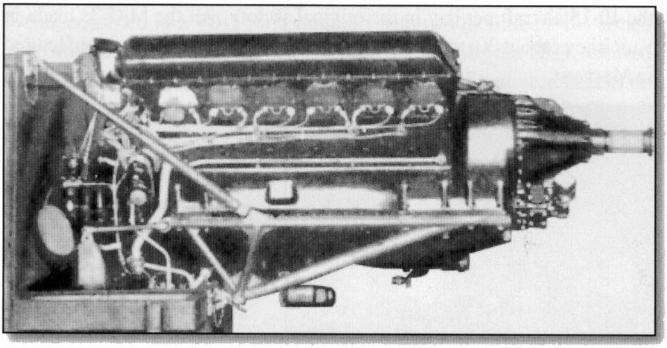
MiG-3 production line.

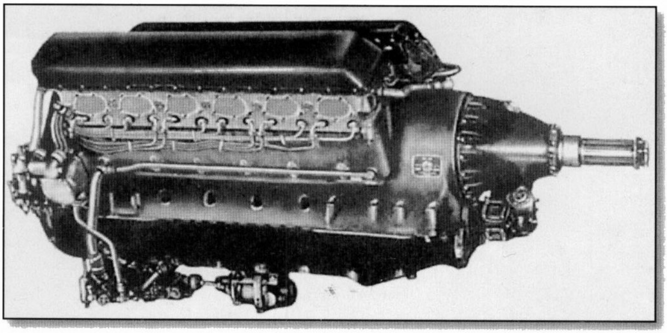
The Mikoyan bureau absorbed the experienced technicians of the Tairov bureau, working on the Ta-3 twin engined fighter. Vsevolod Tairov himself had died in an accident while flying to Kuibishev at the end of December.

The end of production

At that time, the VVS had 3 types of fighters in production, and the MiG-3 was the least popular. Besides, the same plant in Kuybishev could produce Il-2 Shturmoviks too, but their output was very slow, due to a lack of Mikulin AM-38F engines. After the loss of a large factory in Bielorussia, the only remaining factory able to produce the AM-38F engines was the same one producing AM-35A engines for the MiG-3. This was located in Kuibishev too, and activated in late 1941. The two engines were nearly identical, so it was clear that each AM-35A produced was one AM-38F less. In October the decision was made to phase out the MiG-3 to allow more AM-38Fs, and thus more Il-2s, to be built.

During a meeting in Moscow on December 23, in the presence of Stalin, Mikoyan, Petlyakov, Mikulin, Ilyushin and many other, the delays by factory directors in shifting production of MiG-3s and AM-35As into Il-2s and AM-38Fs was discussed. As a result, Stalin sent an angry telegram: "You have deceived our country and our Red Army. Our Red Army needs Il-2s as much as it does bread and water. Szenkman is producing one Il-2 per day, and Tretyakov is producing one to two MiG-3s. This is an insult to the country and to the Red Army. We need Il-2s, not MiGs. This is your





Above:
The AM-35A powering the MiG-3, mounted on an engine mount identical to that of a MiG-3.

Below:
AM-38F of the Il-2 Shturmovik. The resemblance is obvious.

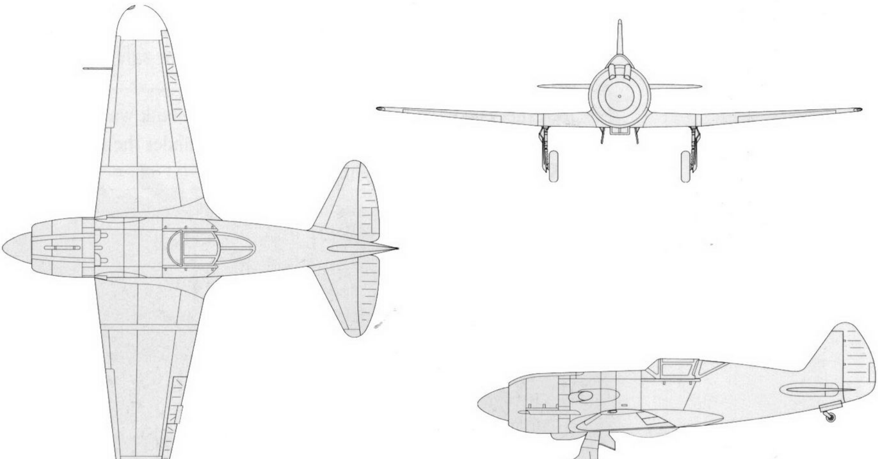
last warning". The telegram led to the immediate suspension of MiG-3 production, while production of the Il-2 grew rapidly, even beyond the planned volume. After returning from Kuibishev to Moscow during April 1942, at the newly organized experimental plant 155 (OKB-155) headed by Mikoyan, many spare parts and sub-assemblies were obtained from Zavod 1 and Zavod 30. This allowed 30 more aircraft to be built, numbered from n.6001 to 6030, all armed with two ShVAK. Two further aircraft, arriving at the factory for major maintenance, were rearmed with two ShVAK. The total production of the MiG-3 by Zavod 1 and OKB-155 was 3172. It is not clear if this number includes the MiG-1, the I-200 prototypes and the MiG-3M-82. The modular structure of the aircraft meant it could be easily maintained by cannibalization, so 2 or 3 damaged aircraft could be used to obtain one airworthy one. Some MiG-3s remained serviceable, on second line duties, until the end of the war.

I-210 (or MiG-3 M-82, or MiG-9 M-82)

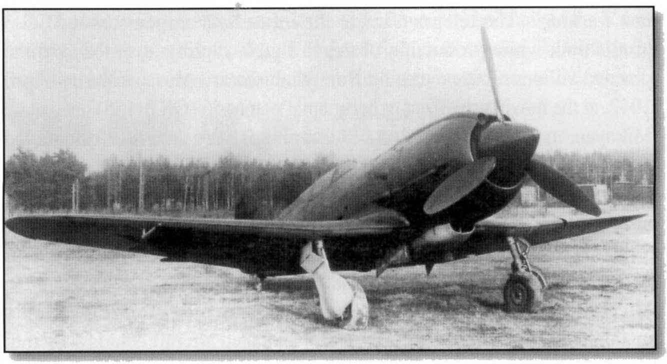
The mass production of the powerful Shvetsov M-82 two-row radial engine began in May 1941 at Zavod 19 in Perm. A.I. Mikoyan, N.N. Polikarpov, P.O.Sukhoi and A.S. Yakovlev were given the task of trying to install this engine in their fighters. The first flyable engine was delivered to OKB-155 on 18 May, and the drawings for the prototype were ready in mid June, July 1 being the deadline for the first flight.

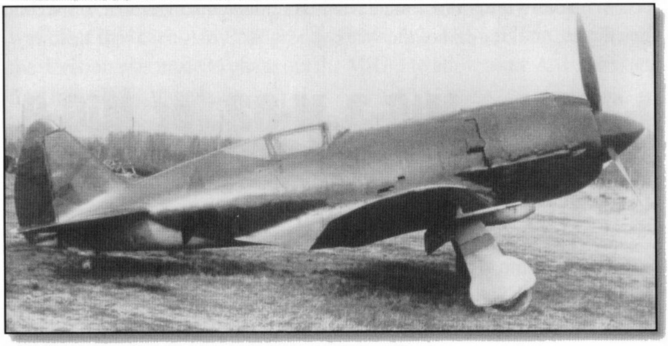
The new machine, called I-210 or MiG-9, differed from the standard MiG-3 by:

- new enlarged fuselage to accommodate the new engine; the rear fuselage was widened too and had a more rounded section;

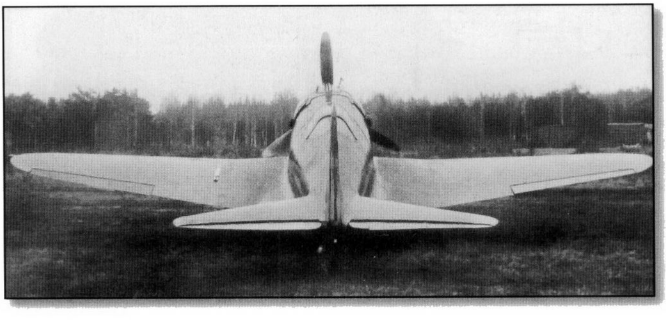


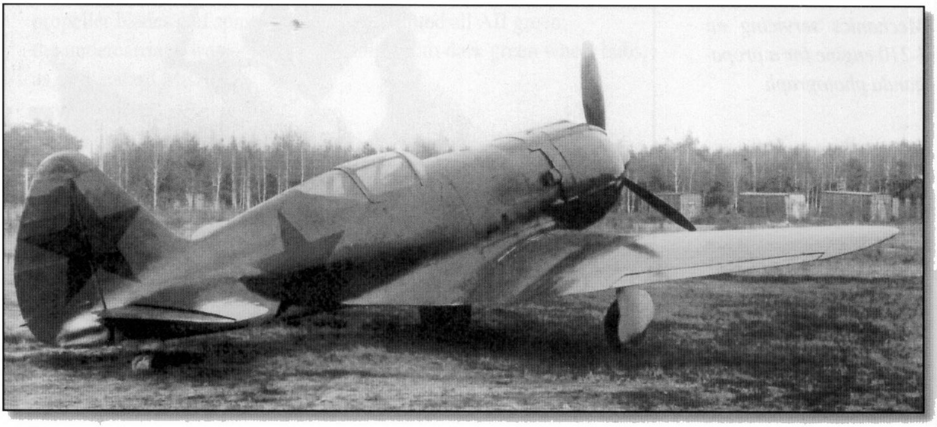
This page & opposite top: *Record photos of the I-210*





- wing moved back by 100 mm for cg reasons;
- new plywood panels on the fuselage sides;
- aerodynamically balanced rudder;
- horizontal and vertical tailplane enlarged (apparently greater chord than on late MiG-3s);
- NACA engine cowling with four easily removable panels;
- cooling airflow control as on the La-5 and I-185; it was made of shutters (probably 12+12) that could retract away behind the spinner by rotating on a side pin;
- two side exhaust stacks;
- four fuel tanks for a total of 488 l; the ventral tank was still protruding;
- two oil coolers VMS-8 installed in a tunnel under the nose;
- AV-5-127A propeller, with 3 m diameter;



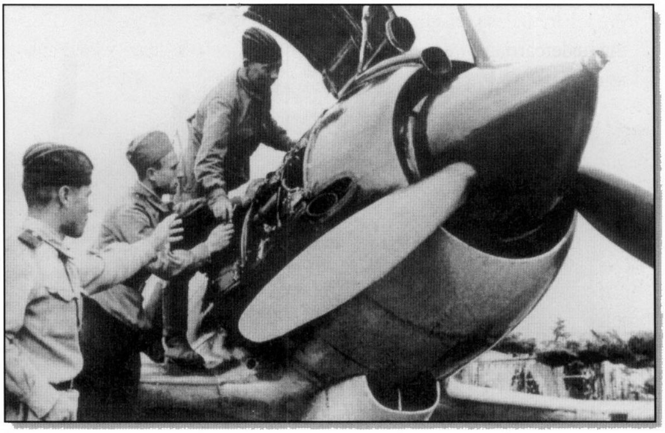


- armed with 3 UBS 12.7 mm with 200 rounds each, (and 2 ShKAS 7.62 mm with 650 rounds each on the last 3 prototypes); all weapons were installed in the nose;
- main landing gear doors without opening access panel

A top speed of 630 km/h at 6500 m and 530 km/h at sea level were calculated. The first example, n.6501, first took off on July 23, 1941, flown by the NII-VVS test pilot M.I.Martselyuk. The second prototype, n.6502, started armament tests on August 25; the left-hand ShKAS was removed. Flight tests were conducted by test pilot A.P. Yakimov. The NII-VVS made its report on the MiG-9 tests at the end of August. They approved of the stronger armament, the better take-off properties and higher speed and rate of climb at low altitudes. The top speed was disappointingly low, 540 km/h at 5000 m. This was partially due to defects in the oil cooler and cowling finish (this wasn't hermetically sealed, and created unfavourable air flows), and to the use of an AV-5L-156 propeller instead of the still unavailable AV-5-127A.

During September 1941, MiG-9 n.6501 was tested in the large T-104 wind tunnel at TsAGI, that confirmed the negative influence of the engine cowling on drag. This would require modifications to the fuselage, but this

Aircraft n.6503, 6504, 6505 were tested at 34th IAP, 6 IAK PVO in June 1942 .



Mechanics 'servicing' an I-210 engine for a propaganda photograph

wasn't possible because of the evacuation of Zavod 1 and OKB to Kuybyshev in October. Three further machines, n.6503, 6504, 6505 were built in Kuybyshev under difficult conditions. They were assembled in the open air because the roof of the workshop wasn't yet built.

They were provided with a Hucks starter dog on the spinner, and ShKAS guns in a lower position than on n.6502. Shortage of Mikulin engines due to the Il-2's priority was already in the air, and Mikoyan hoped to maintain his aircraft in production with the new M-82 engine.

Further tests were made in January 1942 with n.6502, flown by test pilot V.N. Savkin. This demonstrated the absence of engine overheating, and that spin properties were better than the original MiG-3.

When OKB-155 returned to Moscow from Kuybyshev during the spring, all the prototypes were finished. On June, n.6502 was delivered to NII VVS, that sent it to 12th Gv.IAP, 6th IAK PVO. Aircraft n.6503, 6504, 6505 were delivered to 34th IAP, 6 IAK PVO on June 1942 . They took part in combat operations. On 27 October the aircraft of 34th IAP returned to OKB-155 to remedy some defects of the power plant.

On September, n.6502 started the NII-VVS official tests. All the ShKAS were removed, leaving 3 UBS guns. Tests were headed by chief engineer I.G.Lazarev and test pilot V.E. Golofastov. It was necessary to send the aircraft repeatedly back to OKB-155 for work on the power plant, so tests lasted two months. A disappointingly low speed was reached, no more than 565 km/h at 6150 m; besides, the engine installation was unsatisfactory both as regards ease of maintenance and functioning at low rpm.

The poor visibility and the necessity to fly with an open canopy to reduce fumes in the cockpit were defects common to the original MiG-3. The aircraft n.6503, 6504, 6505, after modifications, were delivered to 260 SAD 7 VA on the Karelian front on 27 June 1943. They were employed operationally for about a year before being written off.

Notes on colours:

- the aircraft look to be painted with AII green uppersurfaces and light blue undersurfaces;
- there were red stars in 6 positions;

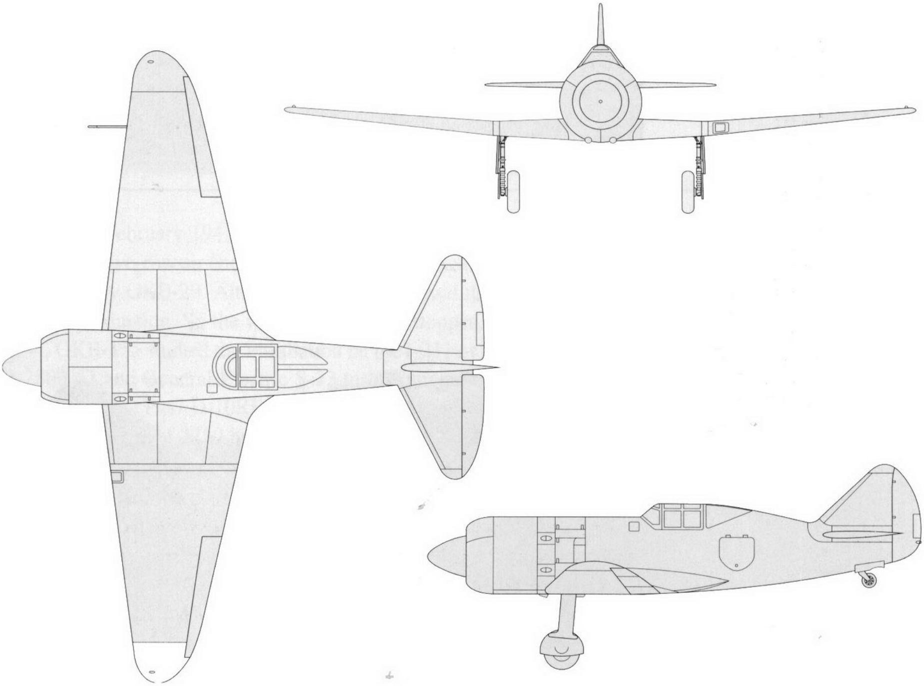
- propeller blades and spinner seem to be painted all AII green;
- the undercarriage was probably light blue with dark green wheel hubs, as on standard MiG-3s.

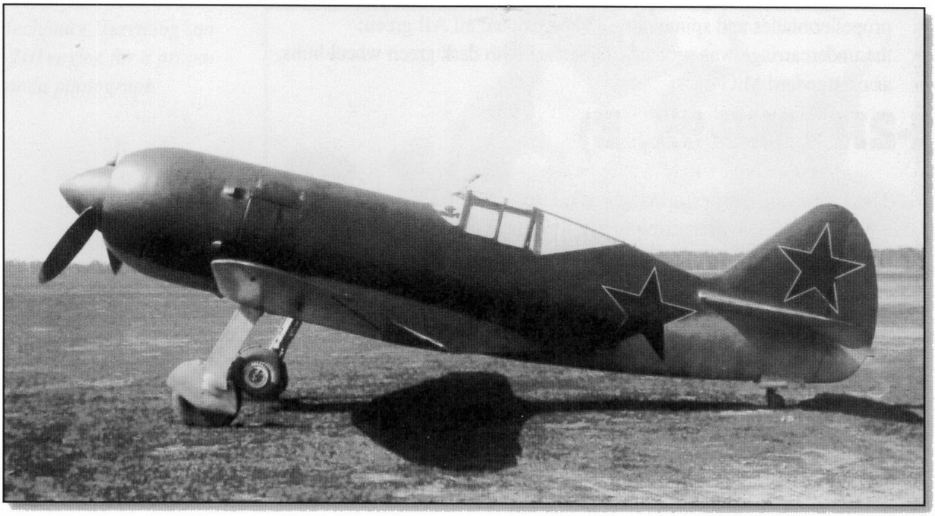
I-211 (MiG-9E, E)

The disappointing performance of the I-210 showed that adapting a large radial engine to the narrow fuselage of the MiG-3 wasn't so simple, but required a major redesign. In late 1942, work began on a new derivative, powered by the improved M-82F engine (in 1943 it was renamed ASh-82F in honour of its designer Arkady Shvetsov). All the previous experiences with the MiG-9 were taken into account, as well as the TsAGI recommendations. A great effort was made to reduce mass and drag.

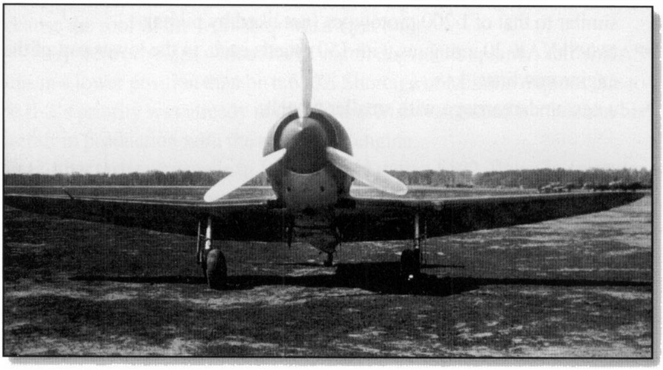
In comparison to the MiG-9, the new aircraft featured:

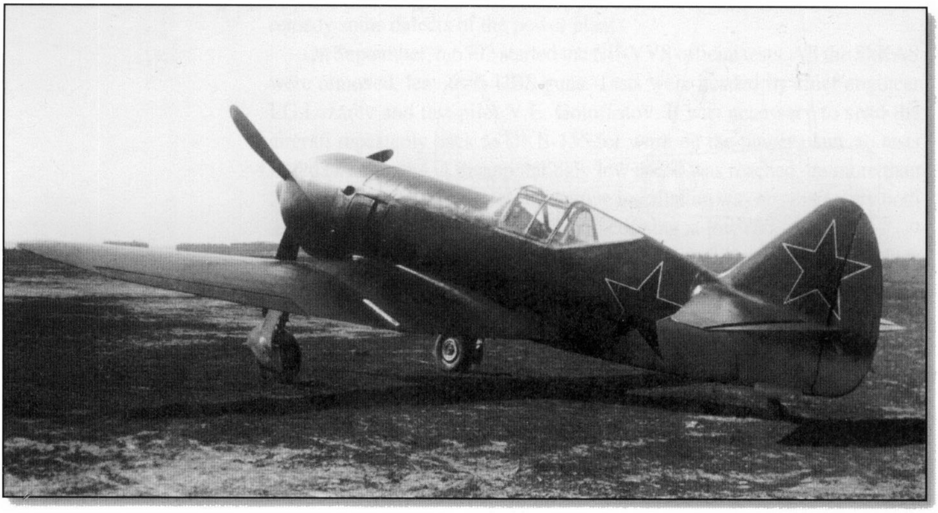
- the improved M-82F engine;
- redesigned and sealed engine cowling;
- oil coolers relocated to the wing roots;
- a new canopy, with good rearward visibility, but hinged sideways and similar to that of I-200 prototypes (not liked by pilots);
- two ShVAK 20 mm guns with 150 rounds each, in the lower part of the engine cowling;
- a new undercarriage with smaller wheels;





This page: *Three views of the I-211 after the application of markings..*





- wings without slats;
- partially reshaped tail surfaces, with horizontal surfaces moved to a higher position;
- internal bullet-proof glass both in front of and behind the pilot
- 280 kg less weight than the MiG-9.

The first prototype was flown on February 24, 1943, by test pilot V.N. Savkin. It reached a top speed of 670 km/h at an altitude of 7100 m, and an altitude of 4,000 m in only 4 minutes. Manoeuvrability was not good. The photos of the prototype show no radio aerial, or slats; before putting this type into service, some modifications leading to weight increase and speed decrease were likely.

For these reasons too, this excellent performance was not sufficient for the MiG to replace the La-5FN which was already in production. According to some sources, 10 aircraft were built and used operationally; other sources say one flying example was built, and 10 abandoned before completion.

Notes on colours:

all three photos of the prototype seem to show AMT green on AMT light blue;

six red stars in standard positions; the stars on fuselage and tail have a light outline, probably silver;

the propeller blades are painted black with yellow tips on the rear face, and unpainted on the front face;

the undercarriage legs, internal face of doors and wheel hubs look silver.

Other projects based on the I-211

During February 1943, OKB-155 studied the installation of the large 18 cylinder two-row air cooled M-90 engine, capable of providing 2000 hp, developed by OKB-29. Although the engine passed its tests, it was never put into production. So the work on the I-211 stopped too. During March 1944, OKB-155 studied the installation on the I-211 of the Pratt &Whitney R-2800-63 and General Electric S-23 turbocompressor, both as installed on the Republic P-47 D-10RE "Thunderbolt" supplied by the USA. With a maximum power of 2250 hp, the aircraft should reach 740 km/h at 10,000 m altitude, and a ceiling of 14,500 m; the full loaded weight was estimated at 3,800 kg. On April 1944 the project was presented to NKAP, but it never resulted in a prototype.

I-230 (or D or MiG-3 U)

On February 26, 1943 the OKB was charged to develop an improved MiG-3 for the PVO, with the following requirements:

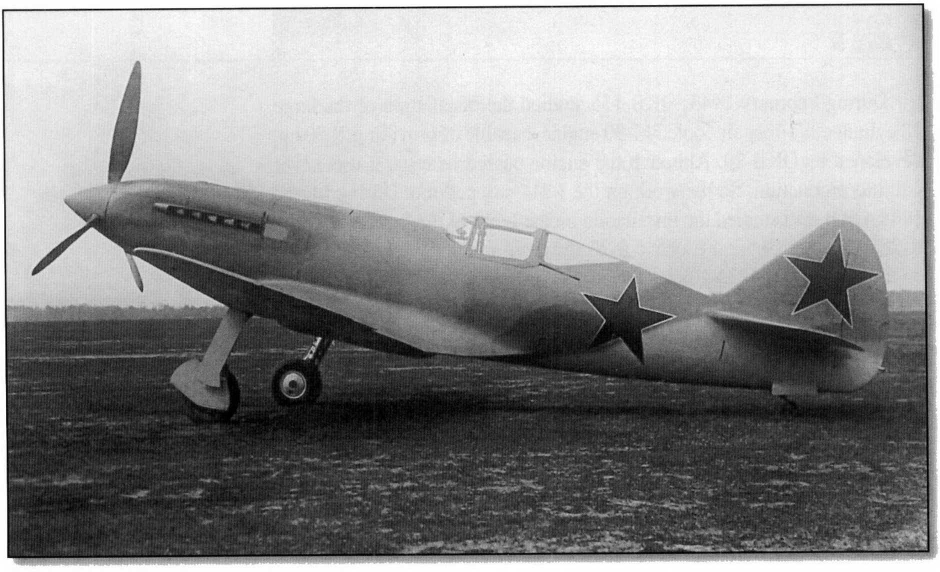
- take off weight 3100 kg
- top speed 670 km/h;
- ceiling 12500 m;
- climb to 10,000 m in 13 minutes.

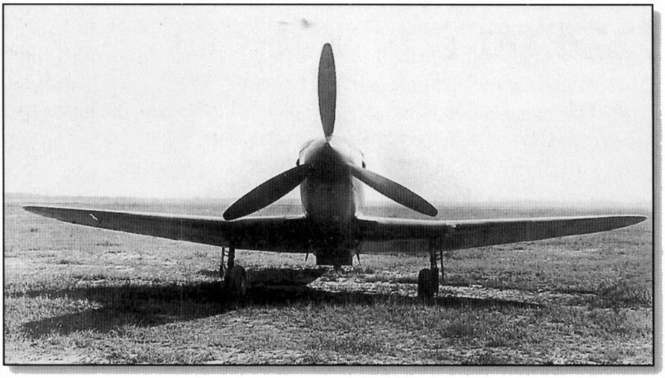
The aircraft was called MiG-3U (uluchshennyi, improved). To reach this performance, a considerable reduction in weight would be needed.

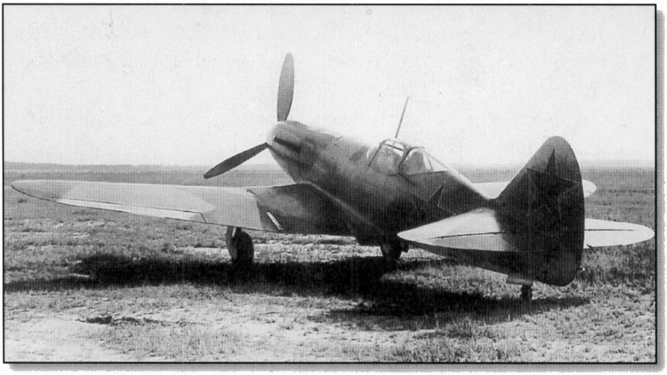
The main differences between the MiG-3U and the standard MiG-3 were:

- the fuselage was lengthened and had no central welded truss, but it was an all-wooden monocoque structure with a plywood skin of 3 layers, 1 mm thick in the wing centre section, and two layers in the tail (not a veneer skin like that of the basic MiG-3). This lightened and simplified the structure;
- the cockpit was moved back and raised, and its canopy was widened and raised to improve visibility;
- the main spar of the wing was no longer interrupted by the radiator tunnel;
- main spars of the wing outer panels were no longer made of wood, but of metal;
- wingtip position lights were moved;
- the fin and rudder were modified;
- the horizontal tail surfaces were raised 200 mm to avoid interference with the new tail wheel mechanism;

I-230, port side view.

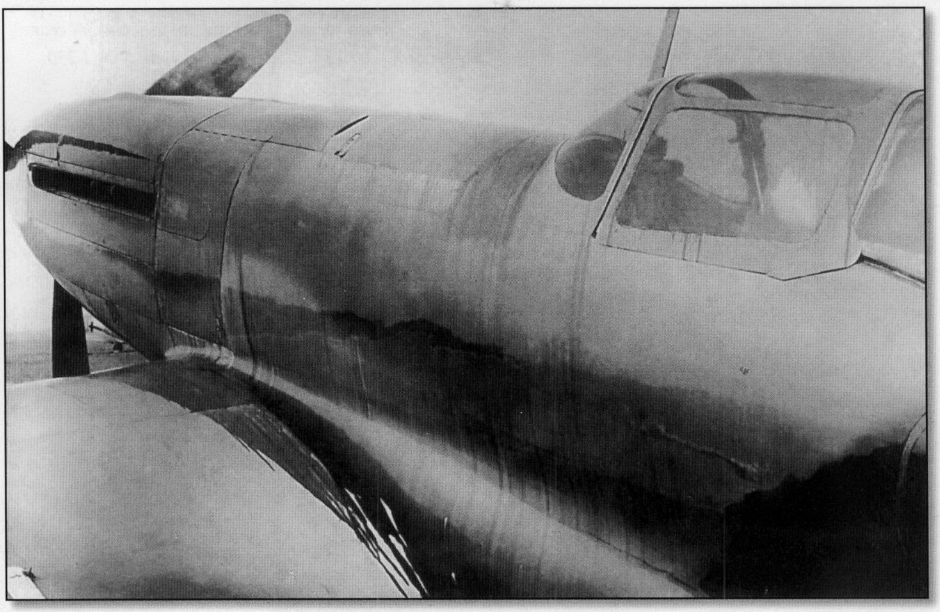






Front (above) and 3/4 rear (below) view of the I-230.

- the main landing gear was redesigned with different doors and smaller wheels, 600x180;
- the armament comprised two 20 mm ShVAK guns with 150 rounds each, placed over the nose and synchronized; they could fire separately or together;
- the P-310 radiator was placed inside the fuselage, below the cockpit; its main air intakes were located in the wing roots, while two auxiliary intakes were located in the ventral position, on the sides of the oil cooler tunnel;
- the air intakes for the supercharger were still in the wing roots, with the radiator intakes;
- the oil cooler "533" was put in a ventral tunnel between the wheel bays;
- the radio set comprised a RSI-3 transmitter and a RSI-4 receiver;
- the gun sight was a PBP-1A;
- a new control column incorporating the brake lever, fire control button and press-to-transmit button was installed;
- the oxygen system was the KPA-3bis with a 4 litre bottle;
- access to radio and oxygen equipment was from a hatch on the right side of the fuselage;



After every flight, the aircraft returned with the fuselage covered with oil. The leak was from the coupling of the reduction shaft, and it was probably due to the hybrid engine.

- the engine was an AM-35A with 0.732 reduction gear, built with spare parts from an AM-35A and AM-38 because of engine shortages; it was 40 kg heavier than the standard AM-35A;
- the propeller was a AV-5L-126A, of 3.2 m diameter;
- a 440 l bladder-type fuel tank, contained in a box of flame-resistant treated plywood, was installed between engine and cockpit;
- it was possible to install two further tanks in the wings, for a further 210 litres.

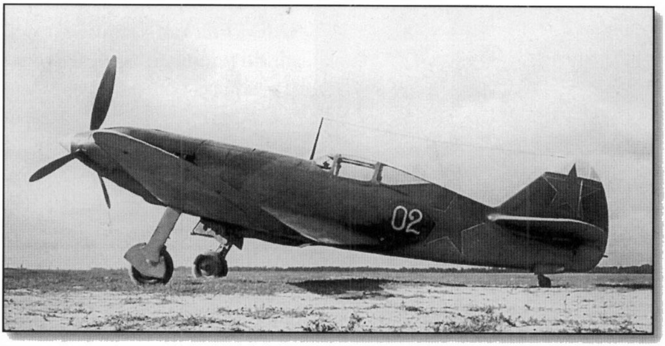
The first prototype, D-01, was first flown by test pilot V.N.Savkin on May 31, 1943. During June and July a further 5 aircraft were built, D-02 to D-06. D-04 had a larger wing, with a span of 11.14 m and a 18.22 mq area. D-01 completed 28 flight tests, showing problems of engine overheating, particularly of the oil.

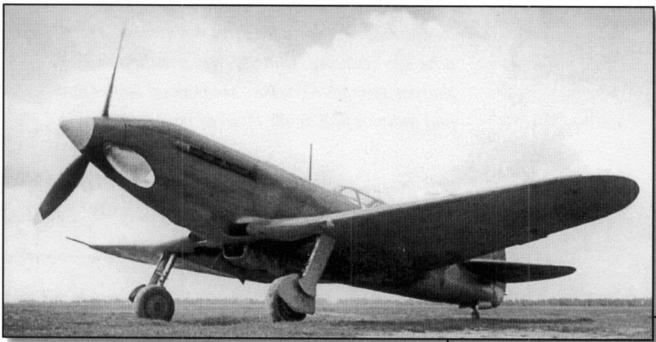
D-01 was transferred to NII-VVS on 23 July for state tests. These ran from 28 July to 6 August, led by chief engineer Captain A.S. Rozanov and test pilot B.I. Khomyakov. The tests showed a top speed of 656 km/h at 7000m, and a ceiling of 11,900 m. The aerobatic performance of the D-01 was good, but landing remained difficult. The cockpit was more comfortable, and similar to other up-to-date fighters. Some vibrations were noted in the tail horizontal surfaces. The most evident defect was oil leakage through the coupling of the reduction shaft, especially at high altitude. After every flight, the aircraft returned with the fuselage sprayed with oil from nose to tail. This defect was considered unacceptable by test pilots, but it was probably due to the hybrid engine.

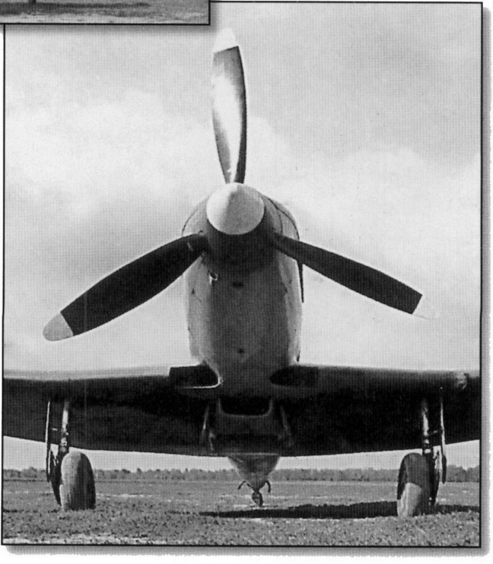
D-01 returned at OKB-155 for repairs and modifications. Then all the prototypes were sent to 12 GvIAP for operational tests. They were flight tested by Leytenant P.A.Zhuravliov and checked by technicians of 12 Gv.IAP. Only

D-01,D-03, D-04 and D-06 passed the checks and were accepted by the unit, while D-02 and D-05 remained at OKB-155 to change their engines. AM-35A engines only arrived on October 10. While waiting for the engines, D-02 received longer span wings. After the installation of the engine, D-02 was transferred to 177 IAP, while D-05 had still oil leakages and was transferred to Zavod n.34 to remedy them.

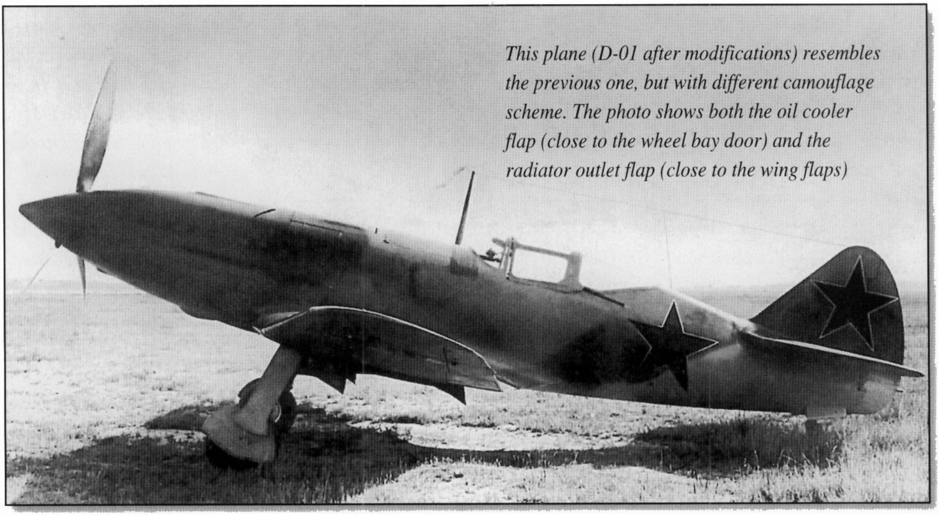
Here are three photos of a prototype numbered white 02. This has the radio mast. It looks to be painted AMT-11 light grey and AMT-12 dark grey, with AMT-7 under-surfaces. Note the position lights, now placed above and below the wing surfaces (as on the La-5) instead of at the wingtips (as for the MiG-3). Note the silver outlines to the stars, and the white tips of tail and wing. The black propeller blades look to have yellow tips. The tail wheel doors are not bulged like those of late MiG-3s.



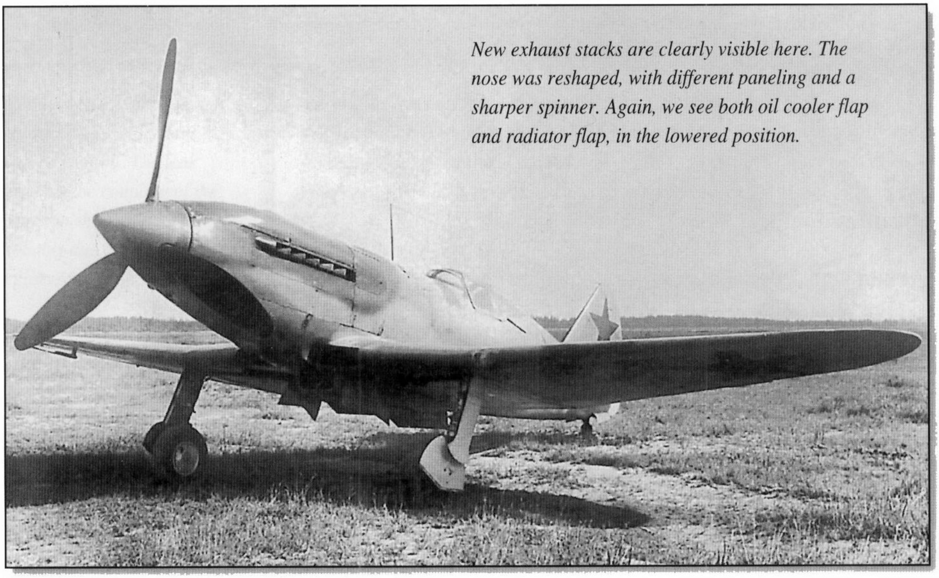




Here we see the ventral air intake for the oil cooler, located between the undercarriage bays; it has a movable flap at the rear. The radiator is located behind the oil cooler, and it is wider. It receives air both from the wing root intakes and from two smaller intakes on its sides (behind the wheel doors, to avoid interference with the undercarriage). Its outlet is closed by another wide flap. Wing root intakes are both for water cooling and for the supercharger inlet.



This plane (D-01 after modifications) resembles the previous one, but with different camouflage scheme. The photo shows both the oil cooler flap (close to the wheel bay door) and the radiator outlet flap (close to the wing flaps)

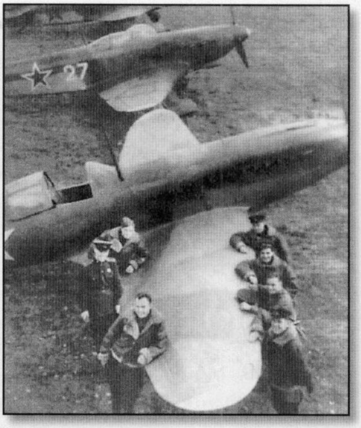


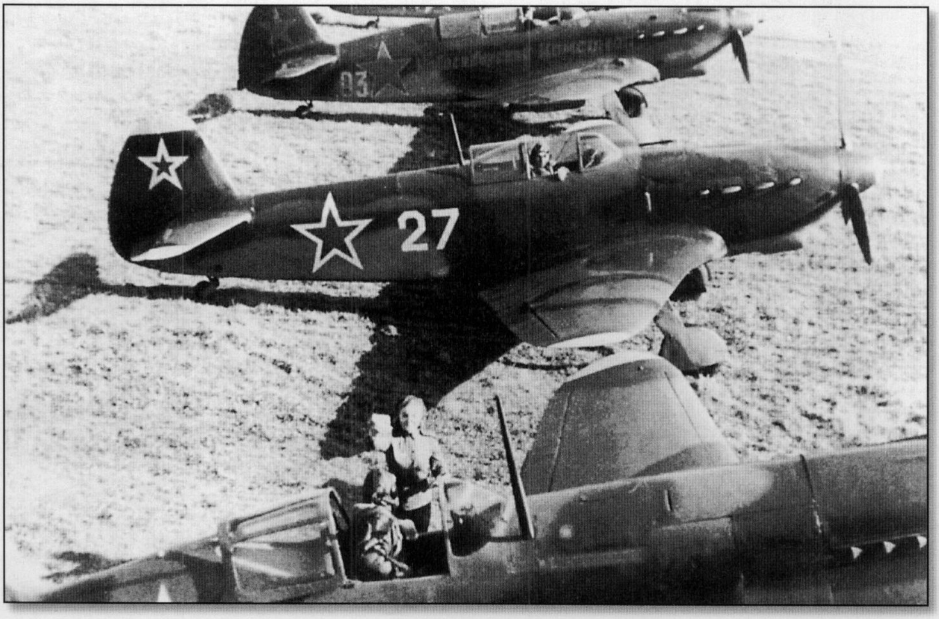
New exhaust stacks are clearly visible here. The nose was reshaped, with different paneling and a sharper spinner. Again, we see both oil cooler flap and radiator flap, in the lowered position.

The D aircraft of 12 GvIAP had some limited success, for example during 1942/43 German Ju-86 high-altitude reconnaissance planes sometimes flew safely over Moscow, at an altitude of 13 km where they were out of reach of fighters or AA fire. Two pilots from 12 GIAP, Edik Nalivaiko with a high-altitude Yak-9D and Lionia Samohvalov with a Mig-3U, managed to get within 1 km of a Ju-86, without reaching it. Nevertheless, after that, such flights over Moscow ceased. All D aircraft were retired from service after some months, due to the previously mentioned problems, particularly the difficulties while landing, that led to two wrecked aircraft.

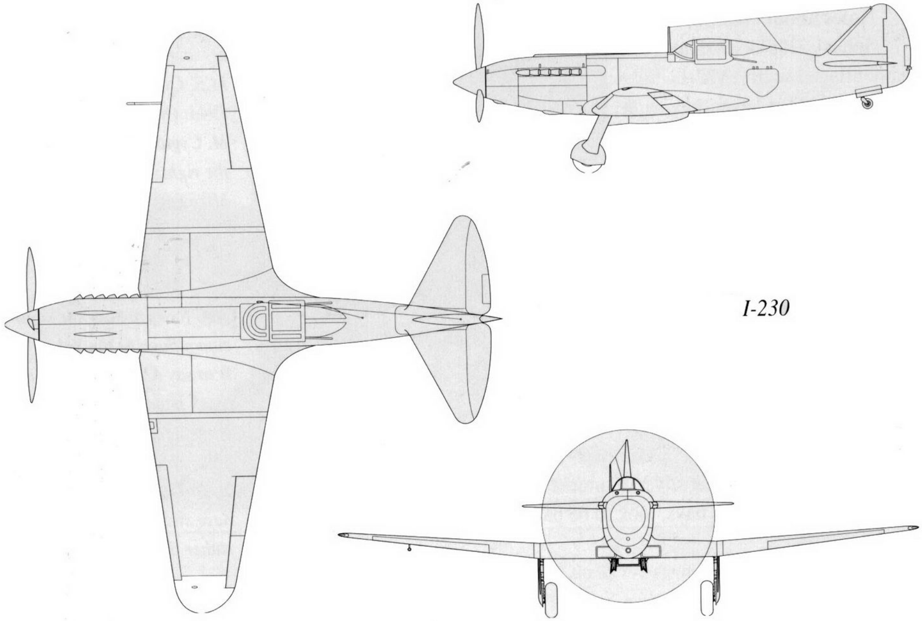
Notes about colours:

Some I-230s look to have been camouflaged with AMT-11 light grey and AMT-12 dark grey, with AMT-7 light blue undersurfaces, with silver outlined red stars in 6 standard positions. At least one example in service with 12 GIAP appears to be painted with the same colours as the Yaks, that is to say AMT-4 green with black, and AMT-7 light blue undersurfaces; stars had white outlines. The propeller blades look to be black with white or yellow tips, sometimes sharply painted, sometimes soft sprayed. The undercarriage legs, their covers and the wheel disks appear silver or, more rarely, light blue, while the central doors, and probably the bays, look to be painted light blue.

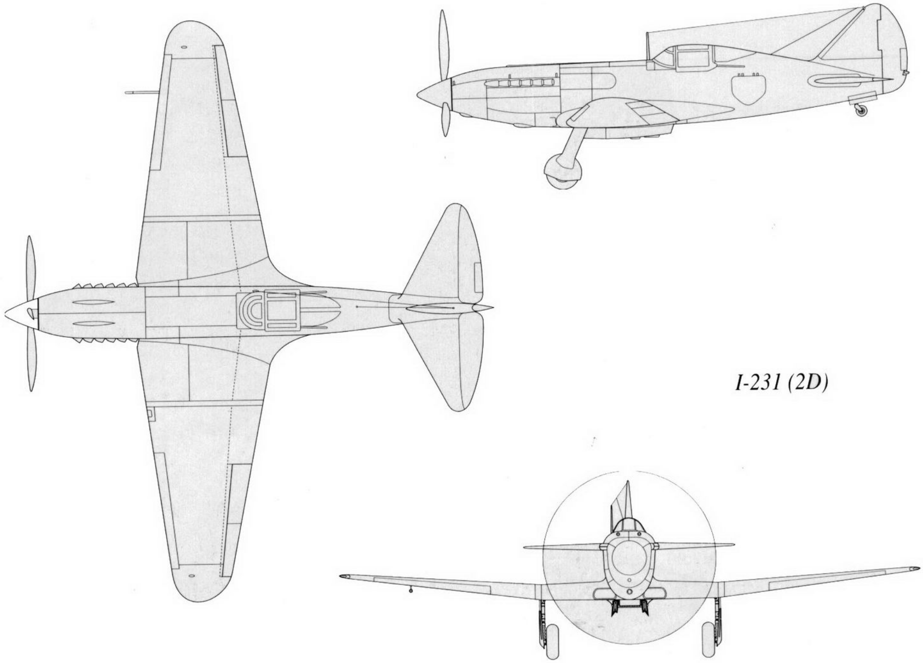




Here we see the line of fighters under the command of M.E. Cyganov of the 12GIAP, 1943. On the left: V. Volohov, M. Cyganov, A. Igoshin. On the right: G. Fastovec, S. Mikoyan, Kosarev
below: the same line. A woman is showing something to the MiG's pilot. This MiG looks to have the same camouflage as the Yaks, that is to say AMT-4 green with black bands, and AMT-7 light blue undersurfaces; stars have white outlines. The third aircraft (a Yak-7) looks to have silver or yellow outlines rather than white ones.



I-230



I-231 (2D)

I-231 (2D)

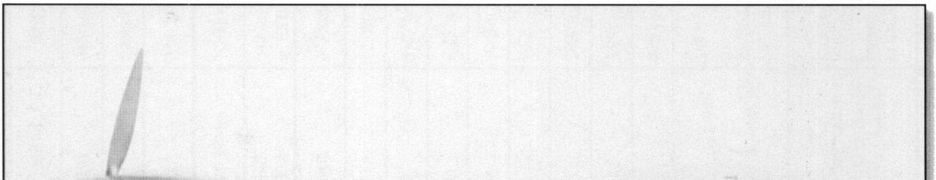
OKB-155 started work on modifying the I-230 with the new AM-39A engine, rated at 1700/1800 hp, in September 1943. The new aircraft was designated I-231, or 2D. At the same time, a new high altitude fighter with the same engine was built. This was the I-220, or A; it was a far larger aircraft than the MiG-3, despite a superficial resemblance. The I-231 was considered as a backup program for this more advanced fighter.

In comparison with I-230, the I-231 had some differences:

- the new AM-39A engine;
- the cowling and nose panels were slightly modified;
- a new enlarged radiator with 30 dm2 effective cooling area was installed; in this was integrated the additional cooling loop (7 dm^2) of the intercooler taking air from the supercharger to the cylinders;
- the fuselage tank was enlarged to 500 l.
- the rear fuselage was all metal, with a lower spine behind the cockpit;
- the rear of the canopy had no central frame, to improve visibility;
- horizontal tail surfaces were lowered by 200 mm (compared to the MiG-3) to avoid vibrations noted on the I-230;

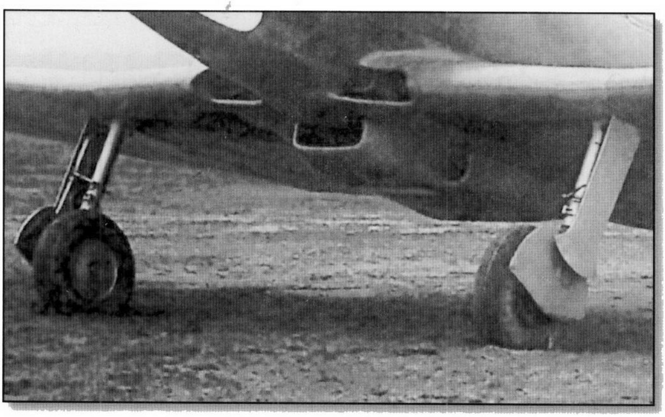
The first flight was made on October 19, 1943. The team was headed by test pilot Captain V.M.Savkin, chief engineer V.Fufurin and motor engineer I.V.Kotov. On 5 November, a malfunctioning of the supercharger obliged the pilot to make an emergency landing at Noginsk airport. Despite the emergency, the landing was executed with the undercarriage lowered, and didn't damage the aircraft; Savkin was awarded the Order of the Red Star for this.

The tests were resumed on November 23, after repairs and an engine change. The top speed achieved was 707 km/h at an altitude of 7100 m, and



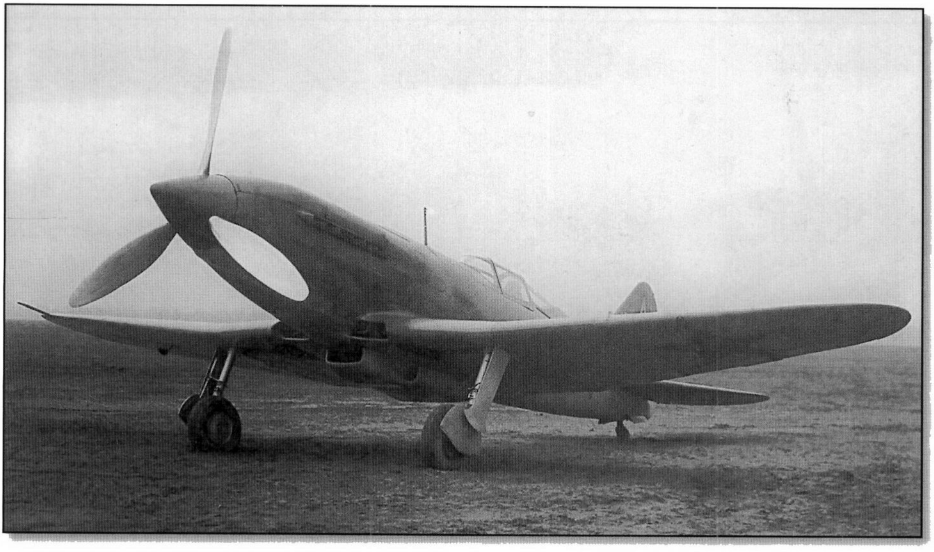
The only prototype looks to be camouflaged in the standard fighter colours of AMT-11 light grey and AMT-12 dark grey with AMT-7 light blue undersurfaces, with white (or silver?) and red outlined red stars in 6 standard positions. The propeller blades look unpainted, while the undercarriage legs and wheel disks look silver or unpainted.

The overall look of the radiators and air intakes resembles those of the I-230, even if slightly larger; the wing root intakes are larger than those of I-230, and trapezoidal. The oil cooler is located between the main undercarriage bays, and ends with an outlet closed by a movable flap. The water radiator is behind it, and receives air both from the wingroot intakes and from the smaller inlets on its sides. It ends with a wider outlet closed by a movable flap. The supercharger inlets are placed in the wing root intakes too.



5,000 m was reached in 4.5 min. This was the highest speed reached by a Soviet fighter to that date. The prototype was transferred to NII-VVS for state tests, after some modifications involving the replacement of the propeller with an AV-5L-126E, which weighed 25.3 kg less. The tests were soon interrupted by an accident, when during a landing the flaps didn't function properly and the brakes were damaged, so the aircraft went off the end of landing strip and turned over. The damaged aircraft was returned to OKB 155 for repairs, and was back again at NII-VVS on 12 May. But on May 19, the engine failed while testing the boosted regime. The delivery of a new AM-39 was delayed, and then the whole AM-39 program was abandoned due to its unreliability, and thus work on the I-231 was abandoned too. The I-231 was the last of the MiG-3 family.

***Below**: I-230 overall view.*



	I-200 prototypes	**MiG-1**	**MiG-3 early**	**MiG-3 underwing guns**	**MiG-3 late**	**I-210**	**I-211**	**I-230**	**I-231**
first flight	May 1940	01/12/40	01/01/41	01/01/41	summer 1941	July 1941	01/02/43	May 1943	01/10/43
No. built	4	100	total of MiG-3 3172			5	1	6	1
engine type	AM-35A	AM-35A	AM-35A	AM-35A	AM-35A	M-82	ASh-82F	hybrid AM-35A/ AM-38	AM-39
Max power	1,200/1,350 hp	1,200/1,350 hp	1,200/1,350 hp	1,200/1,350 hp	1,200/1,350 hp	1,330/1,500 hp	1,700/1850 hp	1,200/1,350 hp	1,700 hp
Max speed with closed canopy	648 km/h at 7000 m	630 km/h at 7000 m	640 km/h at 7000 m	600 km/h at 7000 m	640 km/h at 7000 m	565 km/h at 6000 m	670 km/h at 7100 m	656 km/h at 7000 m	707 km/h at 7,100 m
Max speed at sea level	486 km/h	495 km/h	477 km/h	?	466 km/h	475 km/h	?	505 km/h	?
Service ceiling	12,200 m	11,000 m	12,000 m	?	12,000 m	8,700 m	11,300 m	11,900 m	11,400 m
climb to 5,000 m	5'18"	6'30"	5'40"	?	7'07"	6'42"	4'	5'12"	4'30"
Length	8.16 m	8.16 m	8.25 m	8.25 m	8.25 m	8.08 m	7.95 m	8.62 m	8.62 m
Span	10.2 m	10.2 m	10.2 m	10.2 m	10.2 m	10.2 m	10.2 m	10.2 m	10.2 m
Wing area	17.6 sq.m	17.6 sq.m	17.6 sq.m	17.6 sq.m	17.6 sq.m	17.44 sq.m	17.44 sq.m	17.44 sq.m	17.44 sq.m
Empty weight	2600 kg	2600 kg	2600 kg	2760 kg	2600 kg	2700 kg	2600 kg	2600 kg	2600 kg
Gross weight	3100 kg	3100 kg	3350 kg	3500 kg	3350 kg	3400 kg	3100 kg	3260 kg	3280 kg
Fuel capacity (kg)	310 kg	310 kg	495 kg	495 kg	495 kg	360 kg	385 kg	324 kg	333 kg
Armament	1x12.7 mm UBS + 2x 7.62 mm ShKAS	1x12.7 mm UBS + 2x 7.62 mm ShKAS	1x12.7 mm UBS + 2x 7.62 mm ShKAS	3x12.7 mm UBS + 2x 7.62 mm ShKAS	1x12.7 mm UBS + 2x 7.62 mm ShKAS	3x12.7 mm UBS	2x 20 mm ShVAK	2x 20 mm ShVAK	2x 20 mm ShVAK
External stores	?	6x 82 mm rockets or 2x100 kg bombs or 4x25 kg bombs	6x 82 mm rockets or 2x100 kg bombs or 4x25 kg bombs		6x 82 mm rockets or 2x100 kg bombs or 4x25 kg bombs	6x 82 mm rockets or 2x100 kg bombs or 4x25 kg bombs	?	?	?

Operation Barbarossa

At the time of the German attack, 17 Soviet Air Force regiments (IAPs) based near the Soviet borders had received a total of 917 MiGs, plus 64 received by the Baltic and Black Sea Naval Aviation. In spite of this, only the pilots of few units (20th Mixed Air Division, 41st, 124th, 126th IAP of the Western Special Military District and the 23rd Kiev Air Regiment, 55 IAP on the Southern front) were fully trained on the aircraft.

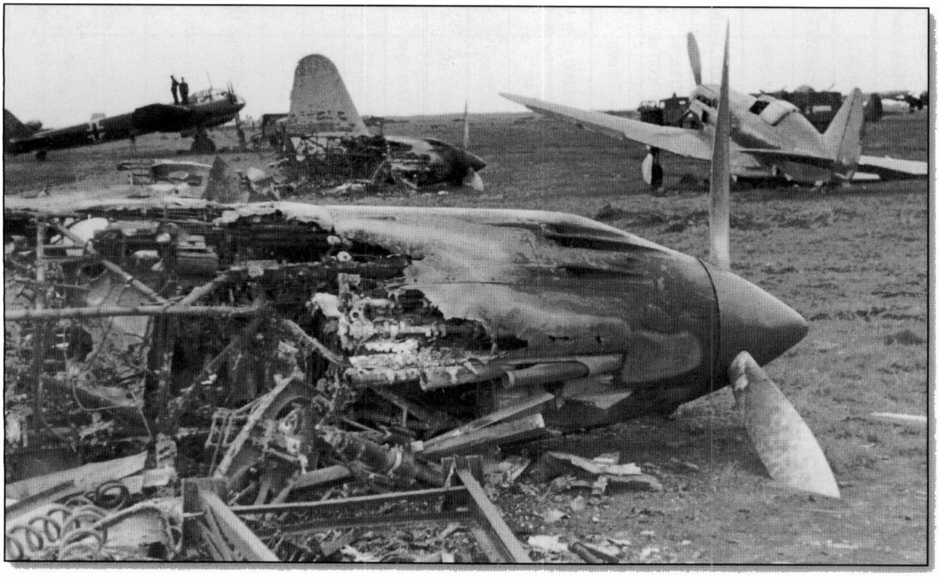
The attack came at a very unfavourable moment for the Soviet Air Force, because:

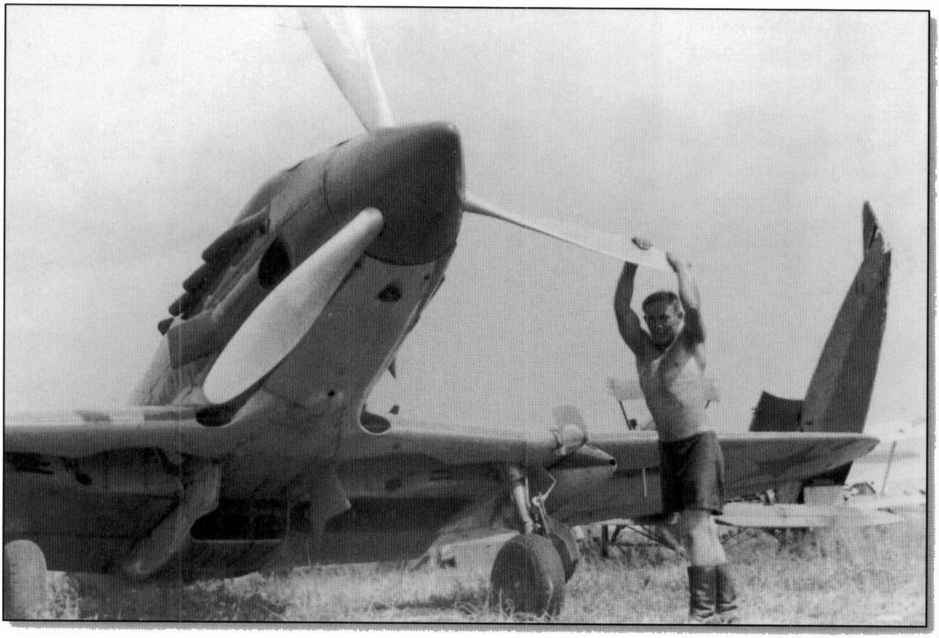
- most of the experienced officers and pilots (many thousands of men) had been imprisoned or executed during the purges waged by Stalin during the late '30s, so that most of the officers at the outbreak of war had limited experience of command and of war;
- every initiative was discouraged, by fear of terrible punishment, and political commissars supervised all unit commanders from 1937 until 1940, when this system was abolished;
- it was a transitional moment between two generation of fighters, that required very different combat techniques;
- the new fighters, such as the MiG-3, were not yet technically mature.

Possibly Stalin was conscious of the weakening of his armed forces, and tried to gain time by delaying the war. He ignored much information indicating a German attack some months before it actually happened. He thought this was false information, possibly from British or German officers that wanted him to react to the provocations to force Hitler to really start a war against him. Or he simply didn't want to believe his "ally" was about to attack

Some destroyed MiG-3s on an airfield captured by the Germans. The aircraft based near the border were most affected during the first attack by the Luftwaffe in the early morning of June 22, 1941, the first day of war.

Jan Koennig





The photo above shows an aircraft captured by German troops in the summer of 1941, probably at Minsk. The underwing pod looks to be without a gun.
Note the open panels of the gun pod ammunition bays and of the wing root fuel tanks, and the flap of the oil cooler outlet in the fully open position on the side of the nose.
Jan Koennig

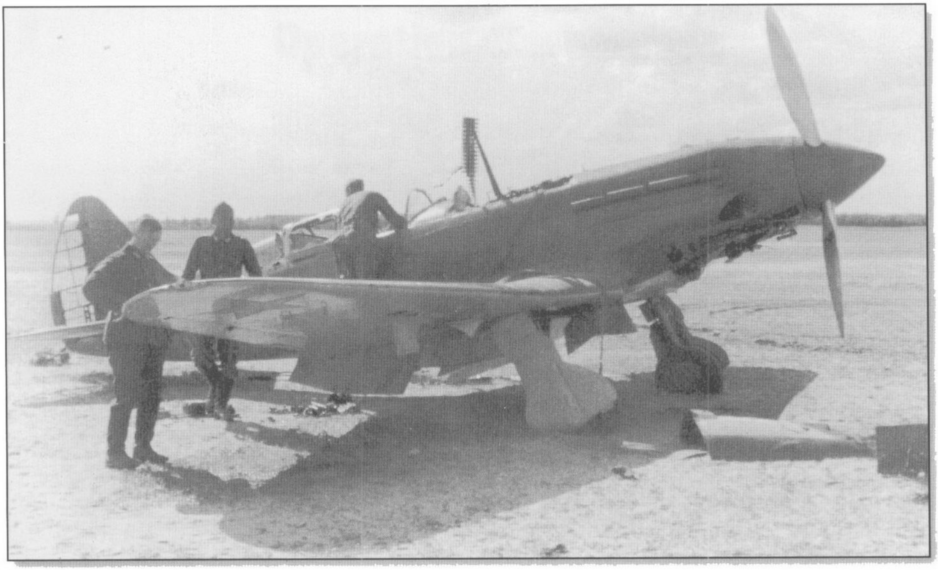
For example, Major General S. Chernykh, commander of the powerful 9th Mixed Air Division of the Western Special Military District, noticed the tension on the border and repeatedly asked for instructions from the High Command. The only answer was "Just don't give in to any provocation". So the aircraft remained lined up on their airfields and uncamouflaged. Many front-line airfields were less than 10 km from the border, within the range of ground artillery.

The 9th Mixed Aircraft Division had a total of 409 aircraft, of which at least 233 were new MiGs. It lost 347 of its aircraft on the first day of war, most destroyed on the ground. In the following days the Division commander, General Chernykh, was arrested as a "people's enemy" and shot, in spite of his service during the Spanish Civil War and his award as Hero of the Soviet Union.

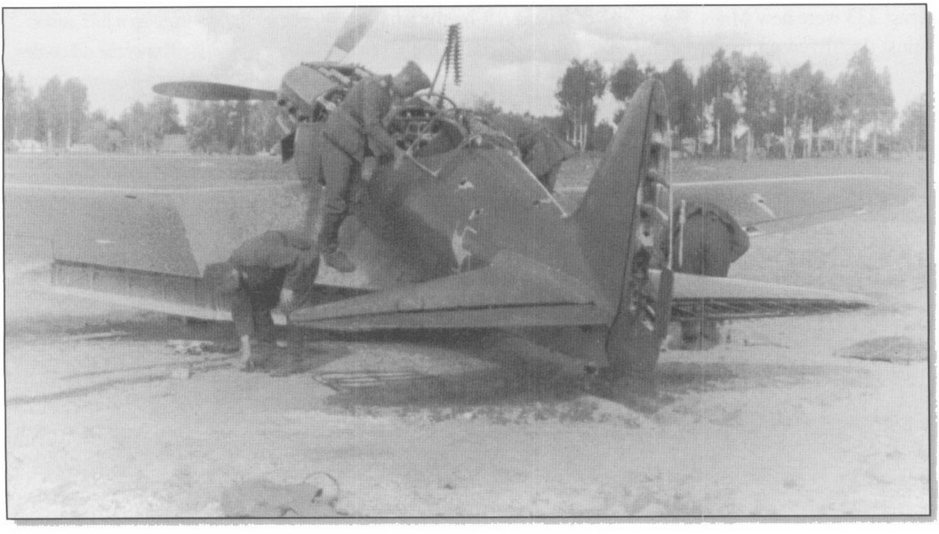
On the morning of 22 June, Soviet Army Air Force Commander General P. Zhigarev sent 99 new MiG-3s to the front, but the decision was wrong. The Soviets had to rapidly evacuate many airfields, and often there was no chance to fly away all aircraft, so many of them had to be abandoned or destroyed.

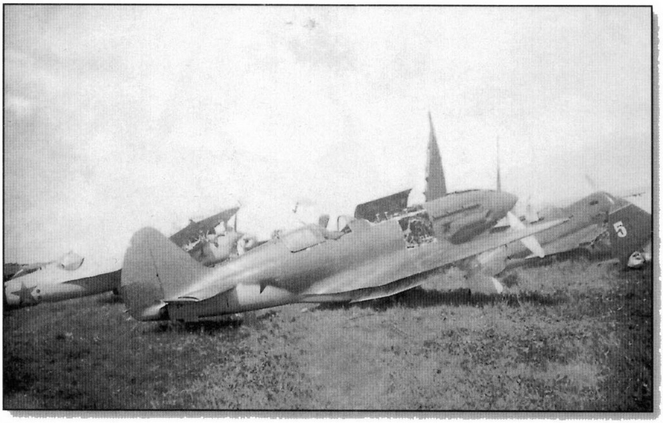
On June 24, there was not a single new fighter in the west, but on 25 June more than 200 new aircraft arrived, and new regiments arrived at the front daily.

The Germans knew the MiG as the "I-61", probably from some intelligence report including the first industrial name of Izdelye 61.



Two excellent photos of an aircraft captured by the Germans. The aircraft appears to have suffered some damage from a bomb blast. Note the swastika over the red star on the fuselage.
The radio installation was relatively rare on early MiG-3s, and became more common on later examples. Note the red star on the wing uppersurface, standard on pre-war MiGs. This was abandoned when the war started, to reduce visibility from above, and was replaced by painting red stars on the tail.
The Germans captured 22 MiGs in near-flyable condition and tried to sell them to Finland. The Finns were aware of the problems of the MiG-3, so they refused to pay for them, hoping to obtain them for free, but this didn't happen.
Jan Koennig.

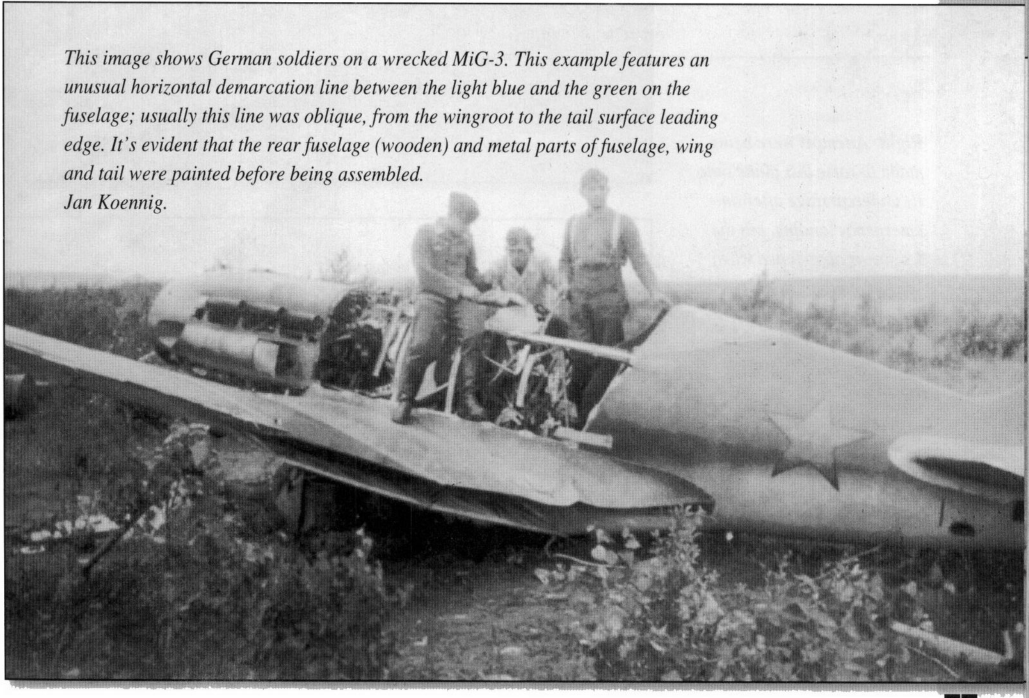




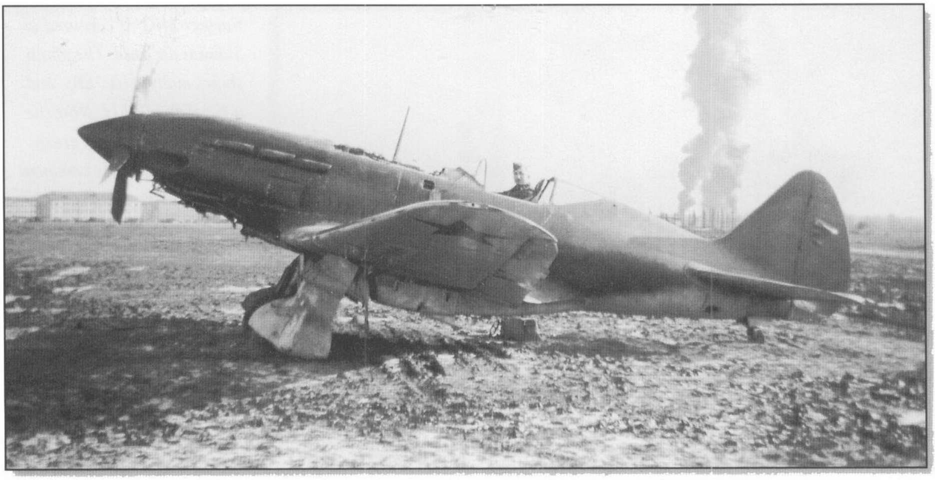
Further MiG-3s captured at Siauliai air base. The photo shows many I-16s, SBs, and a German He-111. Note the uneven colour of the green MiG; this look was common on many early MiGs. It is not clear if it was due to colour alteration (as the difference between wooden and metal parts might suggest), repainting, or if it is a sort of camouflage.

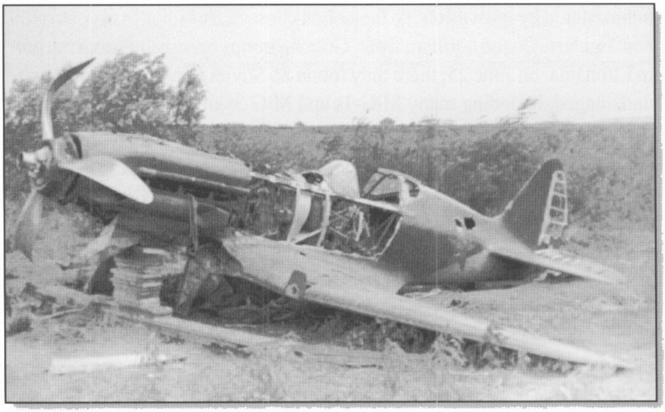
Via Tomasz Kopański

In most units there were both old Polikarpov fighters and MiGs, the latter not mastered by most pilots, so they often chose to fly biplanes instead of the new fighters. On the northern front, German troops occupied Kaunas airport, in Lithuania, on June 25; there they found 86 Soviet aircraft of 8 SAD, most undamaged, including many MiG-1s and MiG-3s of 31st IAP (the unit had 37 MiGs in service).



This image shows German soldiers on a wrecked MiG-3. This example features an unusual horizontal demarcation line between the light blue and the green on the fuselage; usually this line was oblique, from the wingroot to the tail surface leading edge. It's evident that the rear fuselage (wooden) and metal parts of fuselage, wing and tail were painted before being assembled.
Jan Koennig.

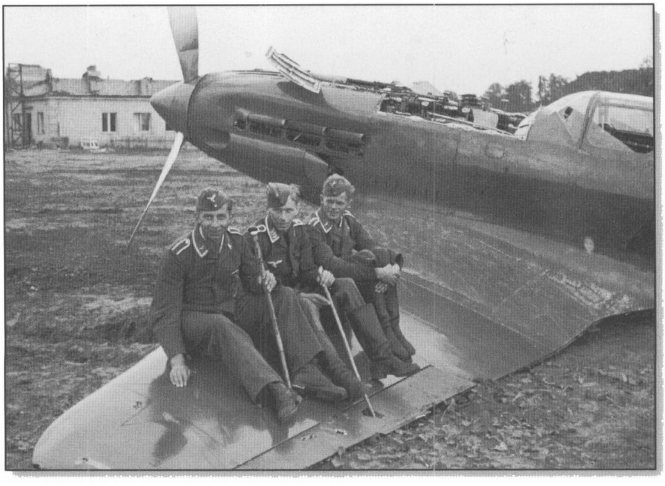




Above: This aircraft looks damaged, in particular its propeller blades are broken (not bent), probably by Soviets before leaving the airfield. No fuselage star is visible.

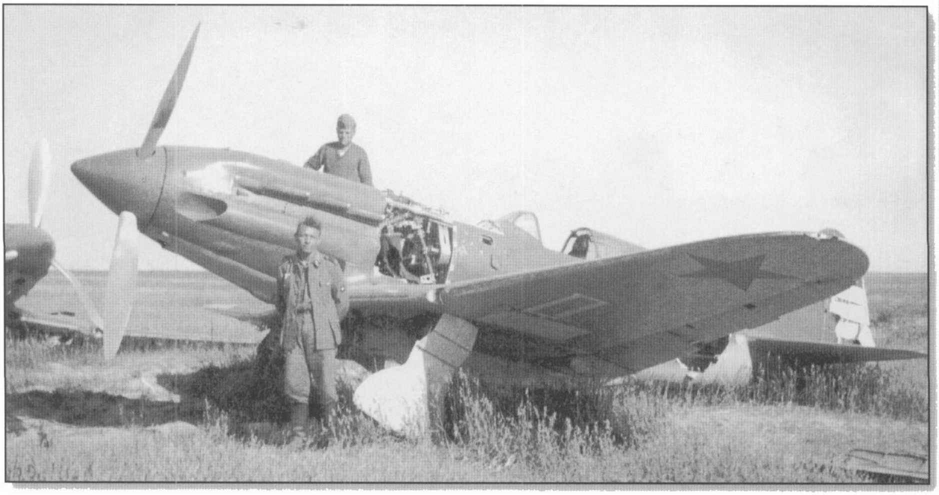
Jan Koennig

***Right**: Attempts were being made to raise this plane onto its undercarriage after an emergency landing, but the work was abandoned when the Germans reached the field.*



***Bottom**: This plane looks to have been brand new before its damage and capture. Red stars on the wings are the typical pre-war standard.*

Denes Bernard

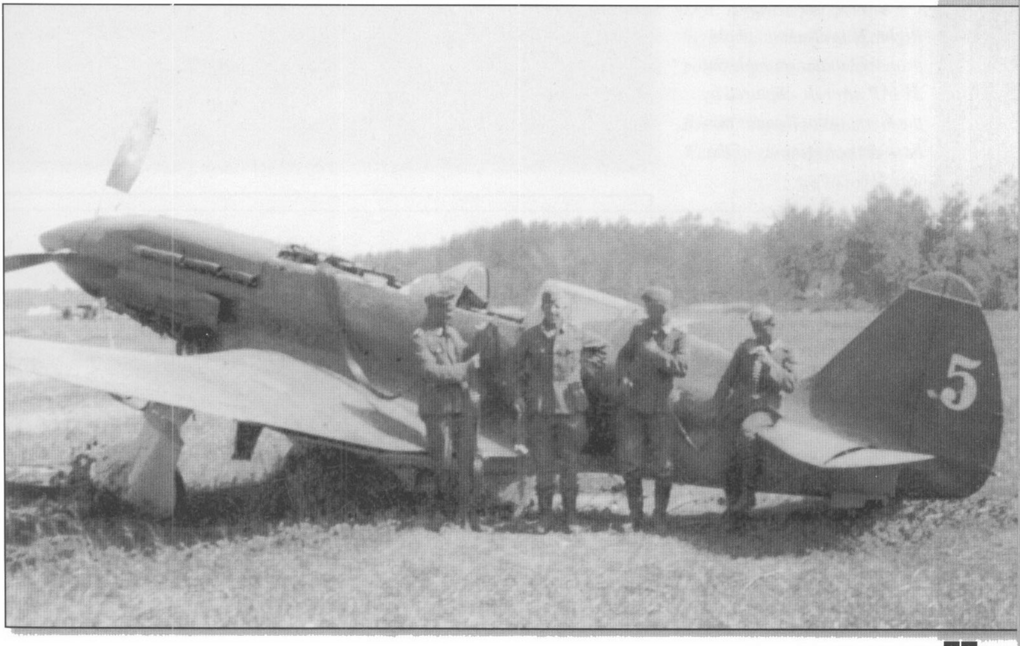


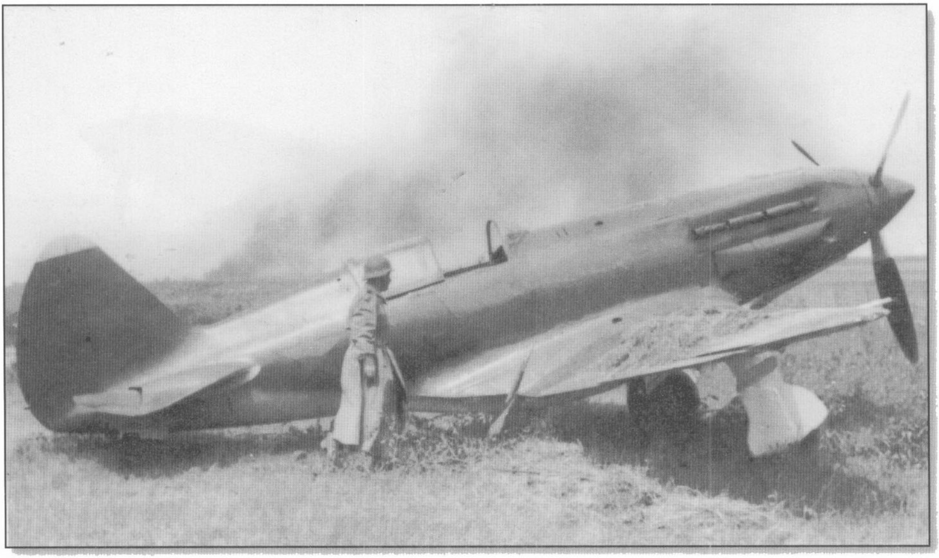
Most early MiG-3s were built with underwing gun pods for two UB 12.7 mm guns, but these weapons were usually removed after delivery of the planes to operational units to save weight. In this image, we see that the hatch for the underwing gun's ammunition was sealed with light adhesive tape.

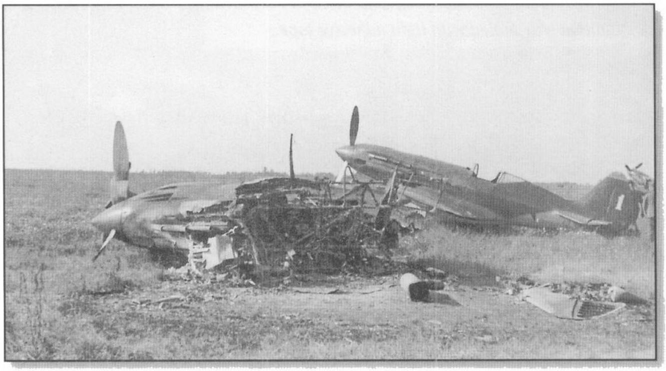
Denes Bernard

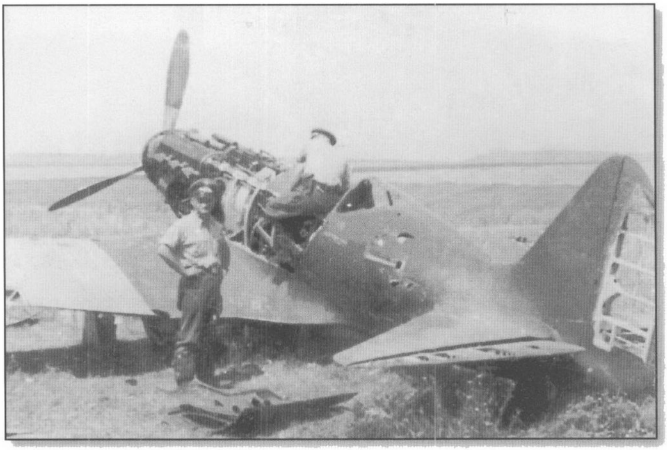
Another plane captured by the Germans, probably at Kaunas airfield, Lithuania. The soldiers have extracted the long ammunition belts.

Denes Bernard









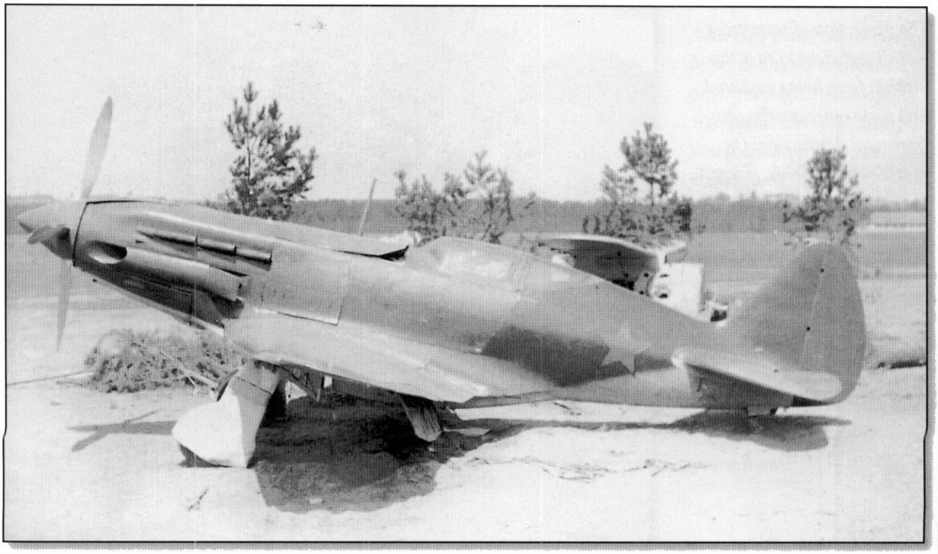
Above: *This plane was apparently intact. The Soviets attempted to camouflage it with some branches on the wings.*

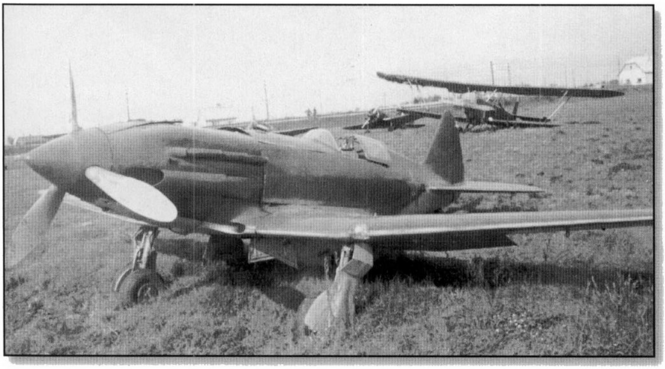
Stratus coll.

Right: *This dramatic photo probably shows examples of 31 IAP aircraft, captured by the Germans at Kaunas air base at the beginning of the war.*

Bottom: *Here is a damaged example captured by the Germans. One wing has a mysterious light colour, perhaps yellow putty after the fabric layer covering the wooden wing had been stripped off. The damage appears to have been produced by a nearby bomb blast; perhaps some souvenir hunters also played a part.*

both via Tomasz Kopański





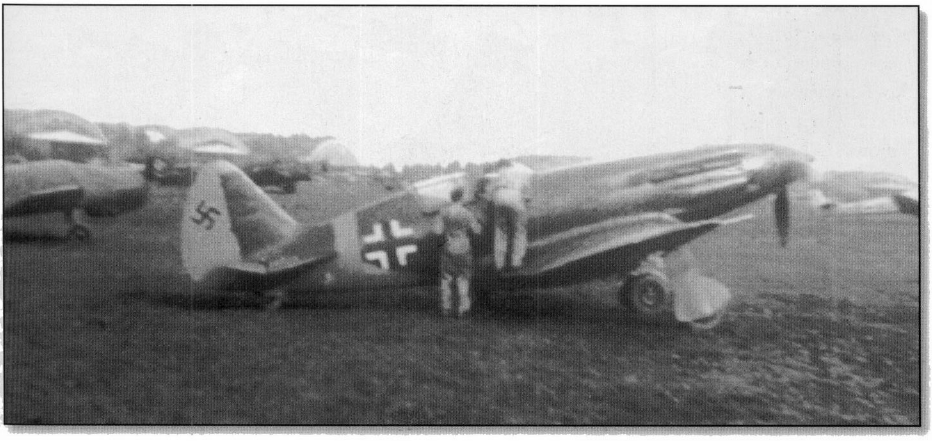
Above: *A beautiful profile of a nearly intact MiG-3. A lot of MiG-3s were found without identification numbers. In the background, an I-153 is lying on the ground.*

Jan Koennig

Left: *A typical perspective highlighting the long and pointed nose of this plane.*

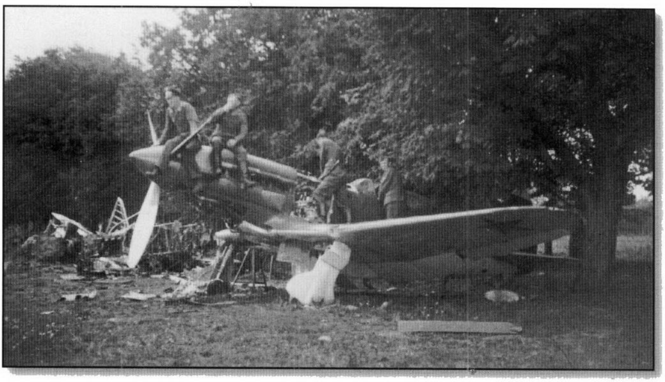
Bottom: *Captured MiG-3 at the Warsaw airfield, August 1941.*

via Harold Thiele



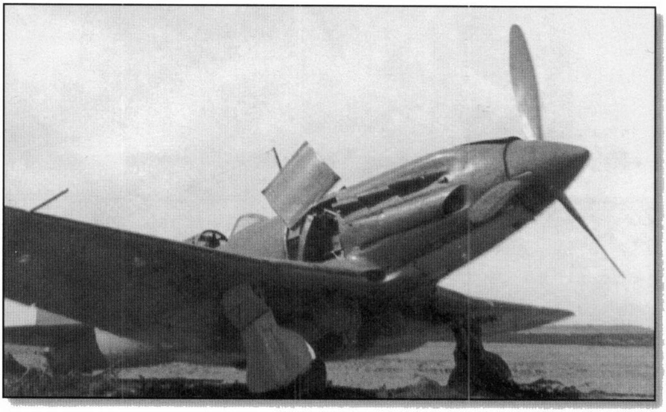
The protection of some trees wasn't sufficient to save this aircraft from being captured, and some other nearby ones from total destruction. On most Soviet airfields, aircraft were left uncamouflaged and lined up on the ground, and this made the task of German aircraft much easier.
Note the light outline around the ammunition door on the wing undersurface; probably it was sealed with adhesive tape.

Jan Koennig

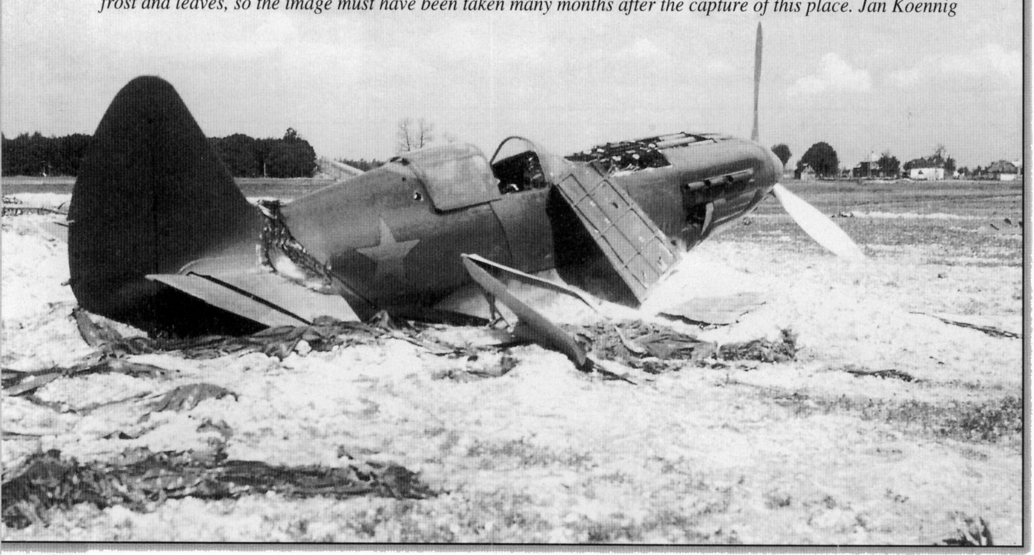


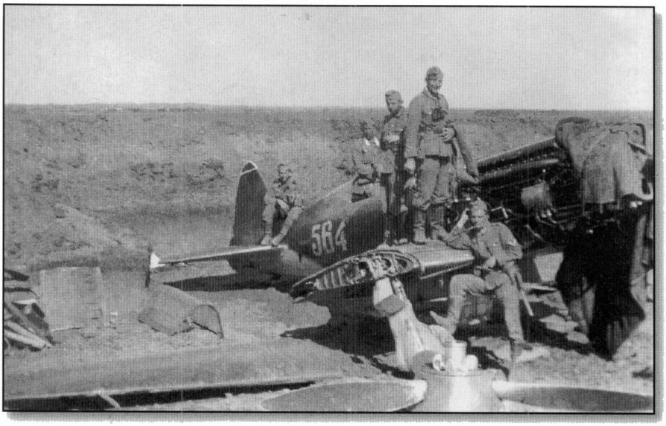
Right: *This image shows one of the side panels locked in unusual position by dzus fasteners. The ammunition boxes of the UBS (rear), ShKAS and the battery (front) are visible.*

Marcin Widomski



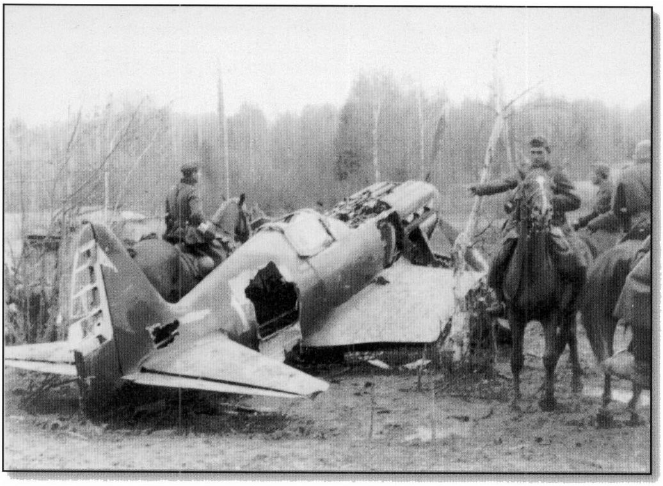
An abandoned MiG-3 with the typical look of pre-war aircraft. The ground appears partially covered by snow, or frost and leaves, so the image must have been taken many months after the capture of this place. Jan Koennig





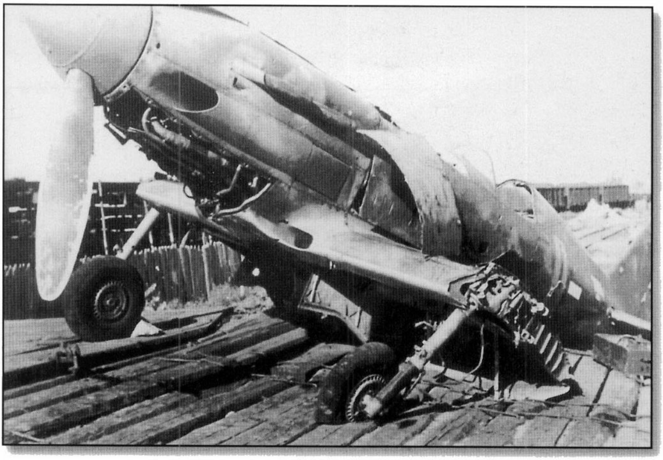
A derelict plane characterised by an unusual 3 digit number on its fuselage. Besides plane 564, plane 220 of the same unit is known from other photos.

Stratus coll.



German cavalry around an abandoned MiG-3, probably in spring 1942.

Denes Bernard

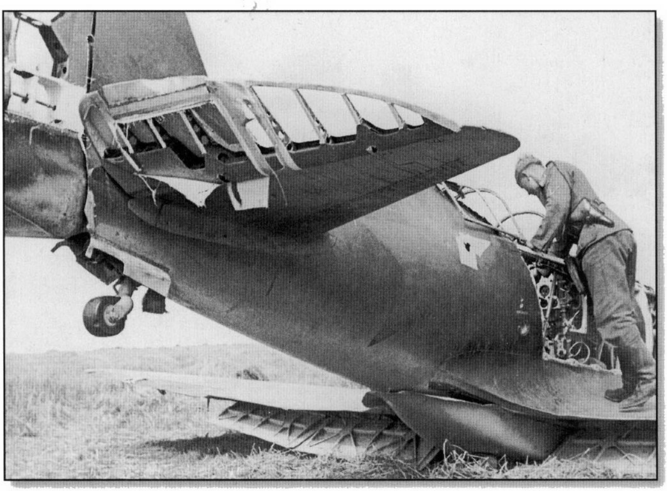


Shot of partially destroyed aircraft "9" on an airfield captured by the Germans. This aircraft belonged to 38 PAE (Air Recognition Regiment) from PVO (Home Air Defence) of Moscow. Noteworthy is the non-standard camouflage, light rectangles on the rear of fuselage should be yellowish putty visible through lacerations of the fabric skinning and the forward-pointing red star (visible on another image of the same plane).

via Tomasz Kopański

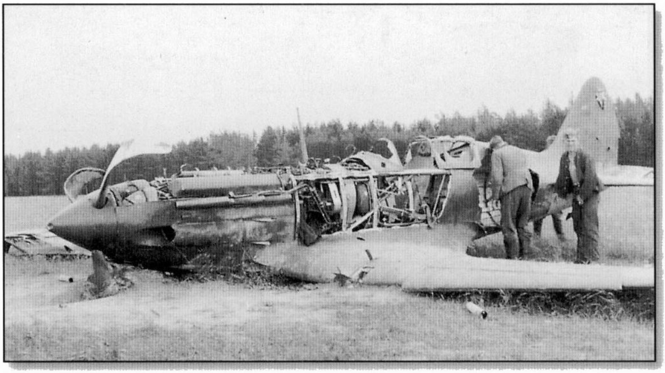
An early type MiG-3 after a forced landing. The large stars were introduced after the outbreak of war, so this image is not from the first few days. The apparently uniform green uppersurface, extended below the tail, looks like a field application.

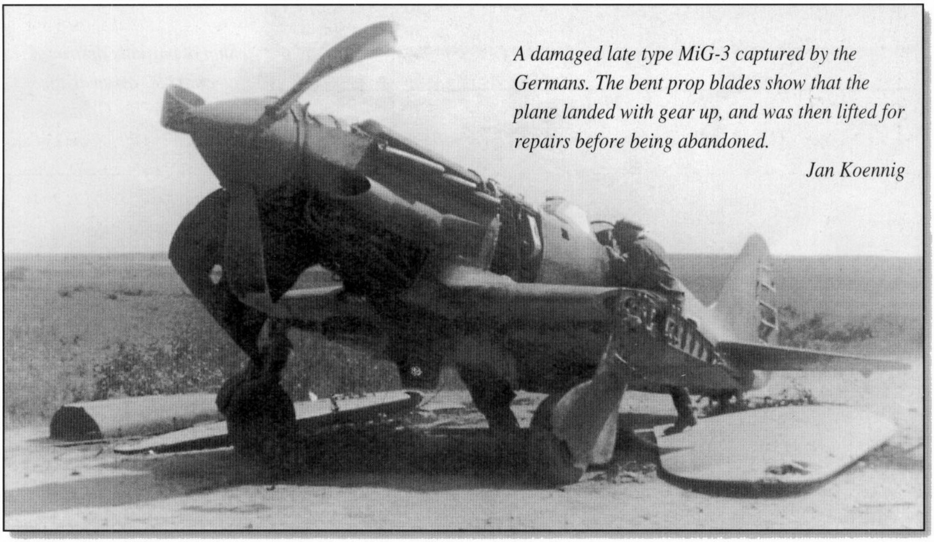
via Tomasz Kopański



Another late type MiG-3 after a gear-up landing. A large hole allows the Germans to look inside the rear fuselage. The pipe for inert gas is visible on the exhaust stacks; we can see part of its way into the fuselage.

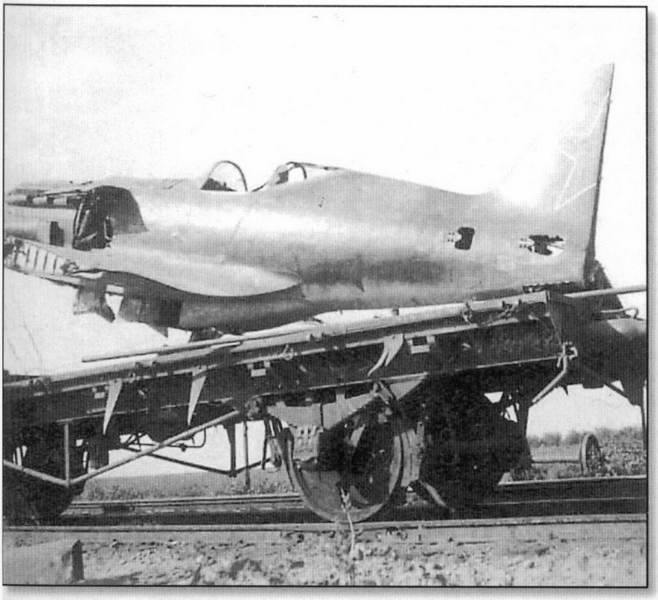
Jan Koennig



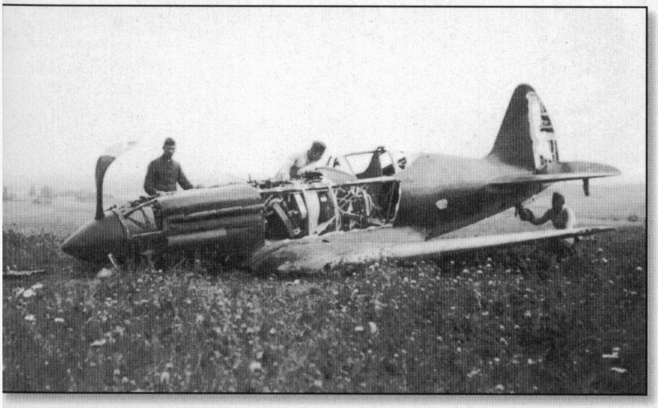


A damaged late type MiG-3 captured by the Germans. The bent prop blades show that the plane landed with gear up, and was then lifted for repairs before being abandoned.

Jan Koennig

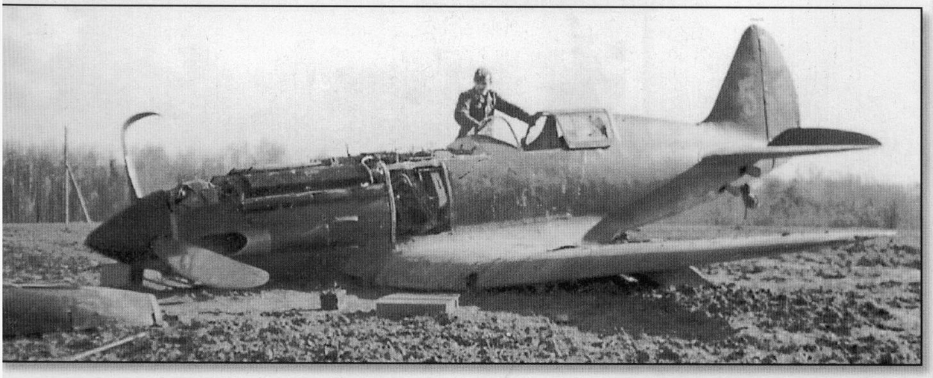


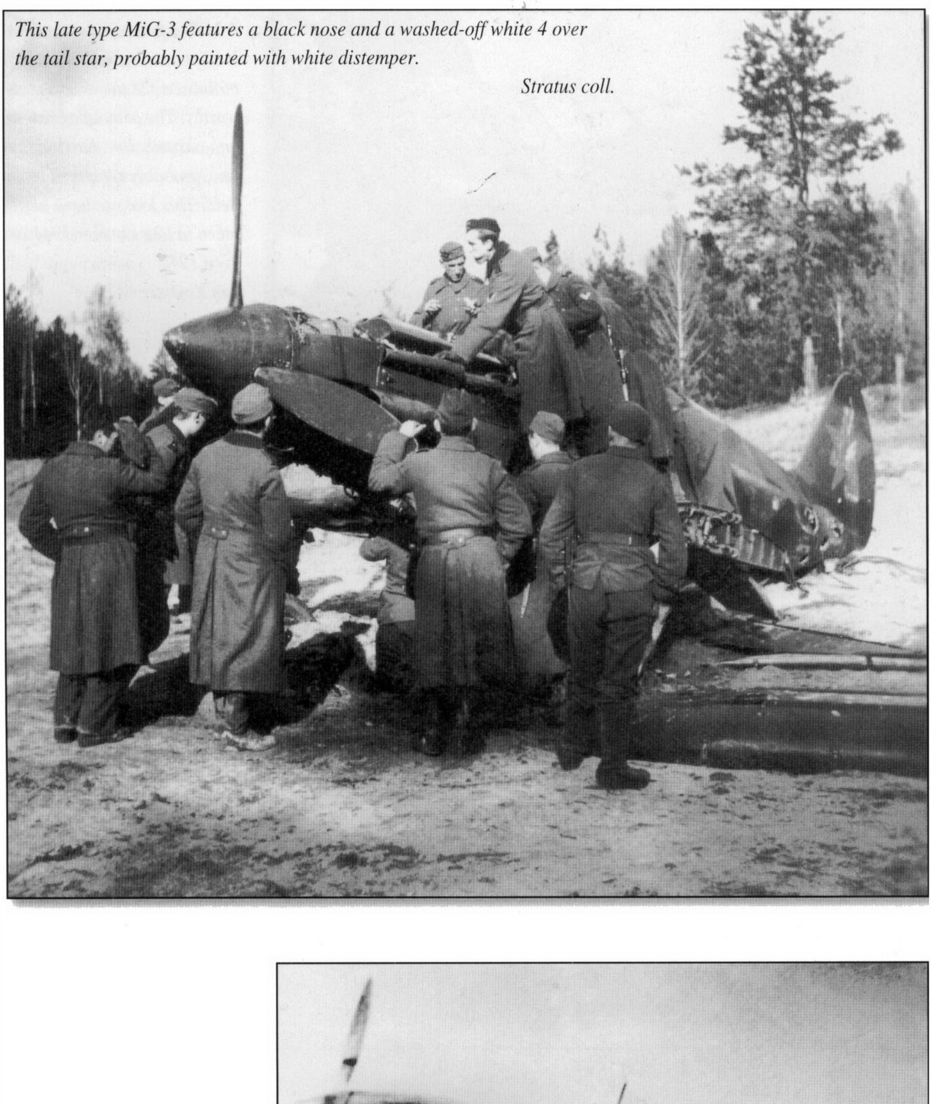
A MiG-3 fuselage captured and loaded on a train. The white outline on the tail star is noteworthy. The camouflage shows an unusually low demarcation line, probably repainted in the field. This looks to have been taken in late summer 1941 or even 1942.
Jan Koennig



***Left**: An early type MiG-3 after a forced landing, still with extended tail wheel*
Denes Bernard.

***Bottom**: Another MiG-3 after a gear-up landing. The tail wheel is extended; probably it was locked in the open position before take-off, because of the unreliability of the mechanism.*
Jan Koennig



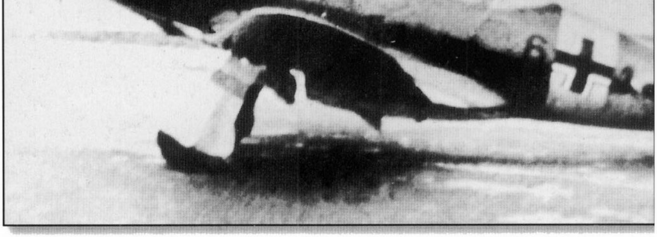


This late type MiG-3 features a black nose and a washed-off white 4 over the tail star, probably painted with white distemper.

Stratus coll.

A MiG-3 in German markings. Note the code 6+1. The Germans called this type I-61, probably because of the name Izdelye 61 (object 61) used in the factory before prototype construction.

via Tomasz Kopański



MiG-3s at war, summer and autumn 1941

Elite fighter Regiments

Five new regiments were staffed by test pilots, on the initiative of Hero of the Soviet Union Stepan Suprun. Such elite units would try to regain air superiority, and show other pilots how to use the new fighters.

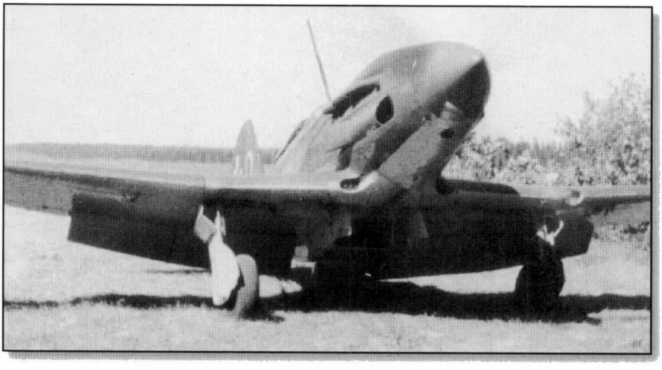
Two of these Regiments, 401 IAP headed by S. Suprun himself, and 402 IAP led by Lieutnant Colonel Peotr Stefanovsky, were equipped with 67 newly built MiG-3 fighters, and sent to the front on June 30.

401 IAP was based at the airfield of Zubovo near Smolensk, on the Western Front, and was employed on intensive ground attack, reconnaissance and air combat missions at low or medium altitude, shooting down 8 enemy aircraft on July 2 and 3. On July 4, Suprun on his own attacked some German aircraft attacking the airfield, shooting down a Ju88, was then shot down by an escorting Bf109 and killed. On his last day, he had downed four enemy planes. He was posthumously awarded Hero of the Soviet Union for the second time.

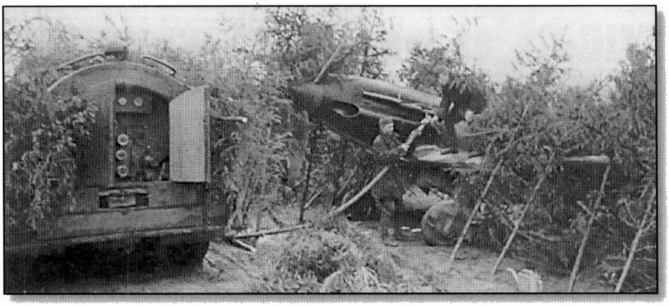
402 IAP, based at Velikie Luki airfield in the Leningrad District, had Captain Proshakov as one of its most able pilots. He even performed a successful night interception of Dornier bombers over Idritsa, shooting down one of them, and then landing in darkness on the unprepared airfield using only his own landing light.

During the summer, both 401 IAP and 402 IAP were assigned to the Moscow Air Defense (PVO).

Another regiment able to fly the MiG-3 effectively was 55 IAP on the Southern Front. It was the unit of the future Hero of the Soviet Union Alexander Pokryshkin, who obtained his first 12 victories flying a MiG-3. Of these, 5 were Bf109Es of Jagdgeschwader 77.



MiG-3 "white 49" of the 401 IAP.

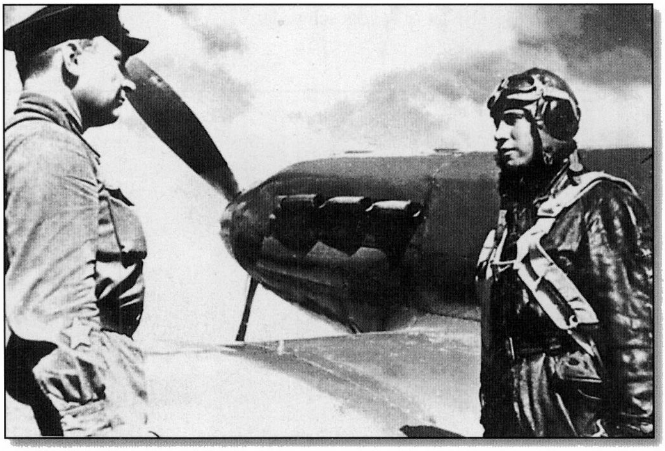


This photo represents a MiG camouflaged with branches whilst being refuelled from a tanker, probably of the 402 IAP on the Moscow front. The MiG is a later type, with inlet pipe for inert gas over its left exhaust stack; late type MiG-3s appeared in July or August 1941. They are easily distinguishable by different exhaust stack fairings, long gun barrel fairings, and different engine cowling panels. They usually feature slats too, and other less evident changes. This aircraft was probably painted with low contrast green/dark green camouflage, and its undercarriage doors appear to be striped green or black. The propeller blades appear green camouflaged too.

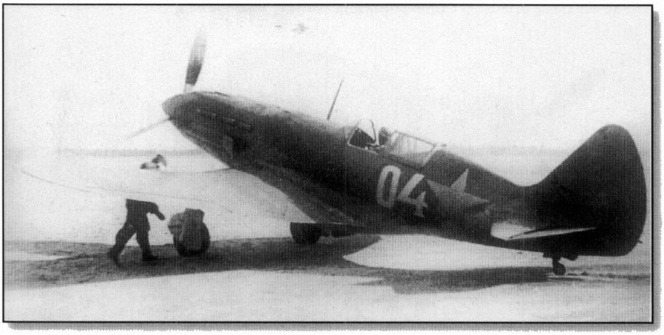
He was one of the first pilots to understand that the good manoeuvrability of the MiG-3 in the vertical plan should be exploited by flying high, then diving on the enemy, gaining speed to be able to choose a good firing position, fire and then regain altitude to escape the enemy.

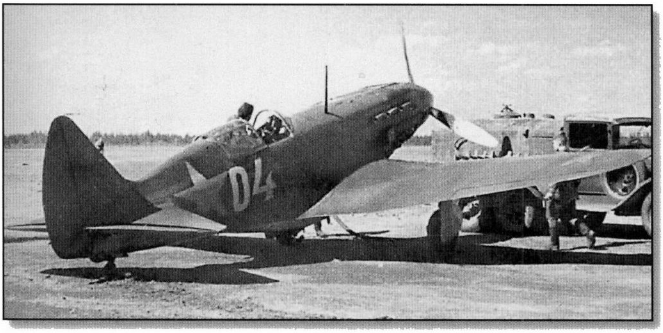
Some high-altitude combats were successful, demonstating that defects shown on early aircraft had been resolved. On September 28, 1941, pilot B Pirozkhov of 124th IAP, Moscow PVO, intercepted an enemy reconaissance plane at 8,000 m altitude, and followed it to 10,000 m before shooting it down.

The MiG-3 was produced in quantity during the summer and autumn 1941, so it was widely used, particularly by the PVO units defending Moscow.



Lt. D.S. Titarenko, of 19 IAP of Leningrad Air Defense, shot down a Ju-88 on July 6, 1941; the crew was captured. It was the first German aircraft shot down over Leningrad. Here Titarenko is reporting a victory to Brigade Commisar F.F. Verov in front of his MiG-3. The plane is an early MiG-3; its nose and wing root seem painted black, with a partially white spinner.





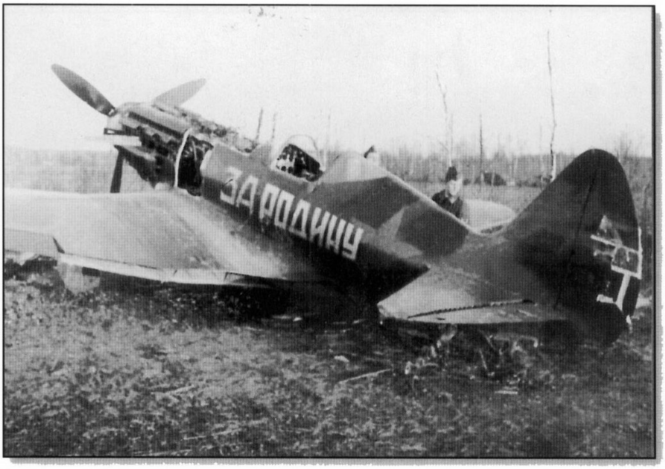
These images represent an aircraft of 7 IAP, Leningrad front, summer 1941. It was piloted by Capt. Sergey. N. Polyakov, a veteran of the Spanish Civil War and of the Winter War against Finland.
via K. Kulikov

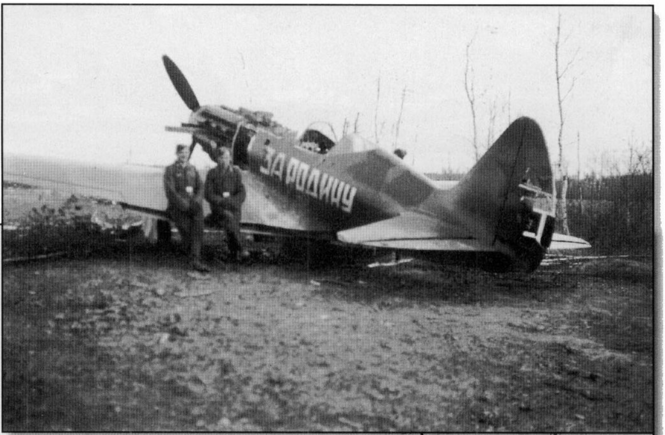
***Left**: This image shows squadron leader G.M.Matveev with his pilots, on the Western Front during August 1941*

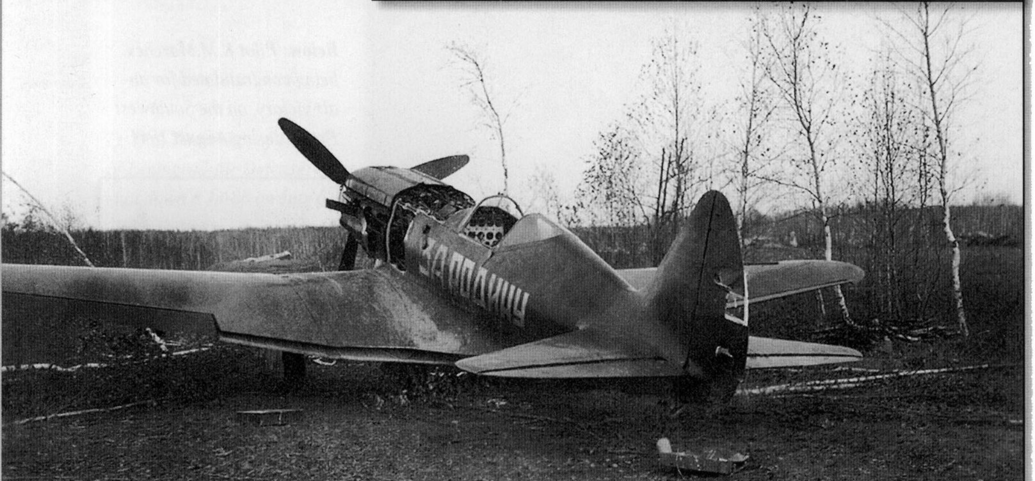
***Below**: Pilot K.M.Marchev being congratulated for an air victory, on the Southwest Front, during August 1941.*

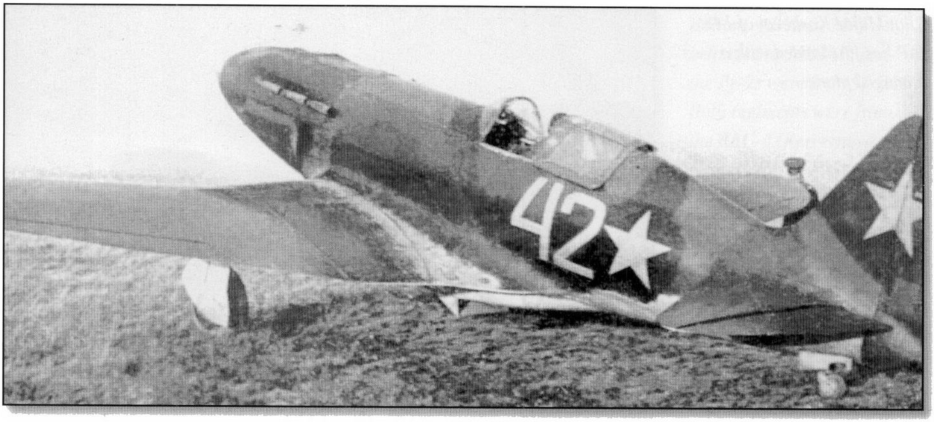
This plane, captured by the Germans, features the "za rodinu" ("for homeland") inscription on its side. The photos were probably taken during autumn 1941. Although its tail wheel doors are still of the early style, other images of it show details of the engine cowling typical of late type MiG-3s. Note the pale colour of the instrument panel.

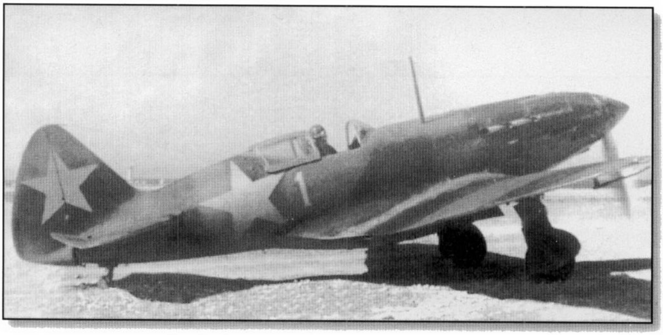
Photos: Tomasz Kopański, Denes Bernard, Przemysław Skulski.





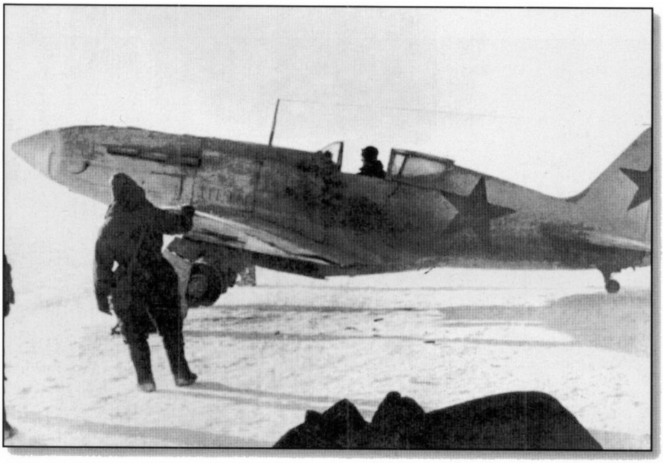






Top: *Here is an early type MiG-3 of 7 IAP, Leningrad Front, in October 1941. The stars look pale, but this could be a result of the type of film used or the use of a red filter on the camera; it can be seen on many photos of that period. A vaguely darker line inside the numbers could be interpreted as red numbers with a white outline. The camouflage shows evident traces of repainting.*

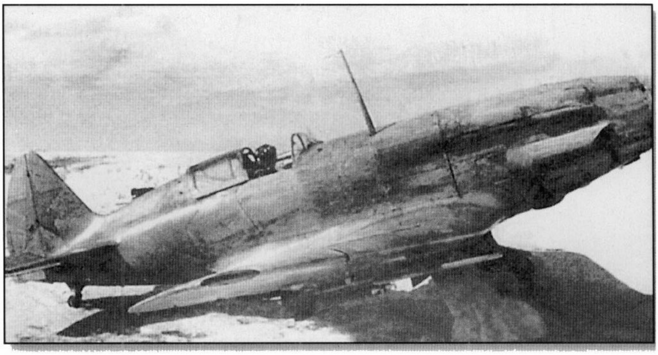
MiG-3s during winter 1941/42



Middle: *A late type MiG-3 of 62 IAP VVS ChF (Black Sea fleet). This image shows unusually light red stars too, possibly due to a red filter.*

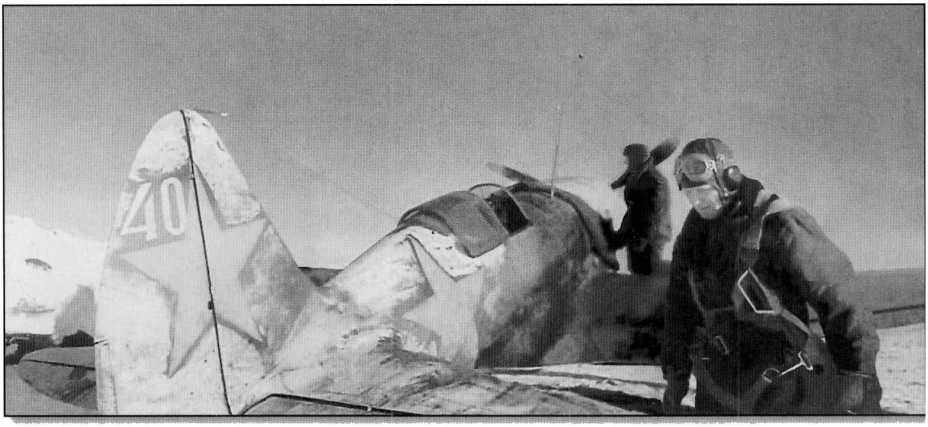
Bottom: *An all-white aircraft during the winter of 1941/42. Photos of early type MiG-3s during the winter 1941/42 are relatively rare, the later version was far more common in this period.*

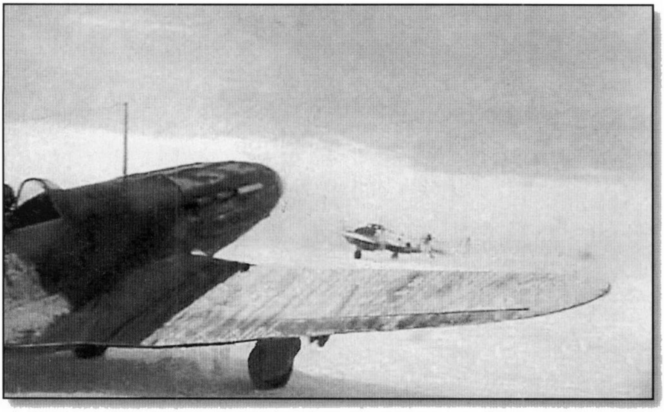
Pilot Major Koshevoi of 148 IAP has just landed with a damaged plane.



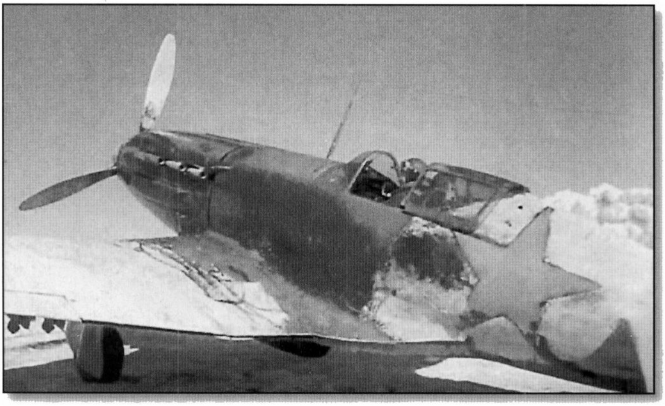
***Above**: Here is an aircraft with a roughly brushed white winter camouflage on the Moscow front, winter 1941/42. Note the rockets under the wing.*

***Below**: MiG-3 Nr.40 of 148 IAP on January 1942, Brianskiy front. The pilot is Lieutenant Panfilov Evgenyi Maksimovich. The use of this style of partial white winter camouflage is unusual on MiG-3s. The engine cowling is fitted with a cover that is white on one side and dark on the other.*



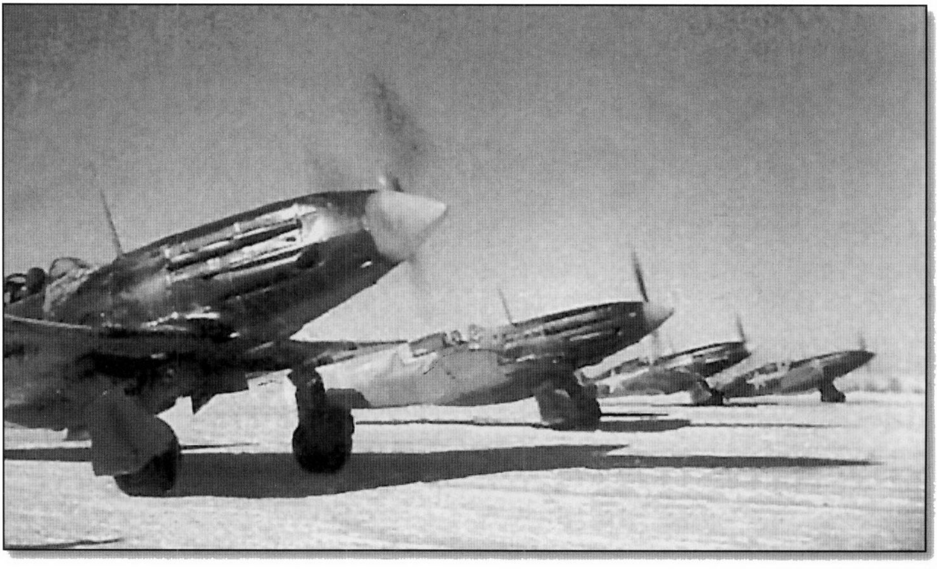


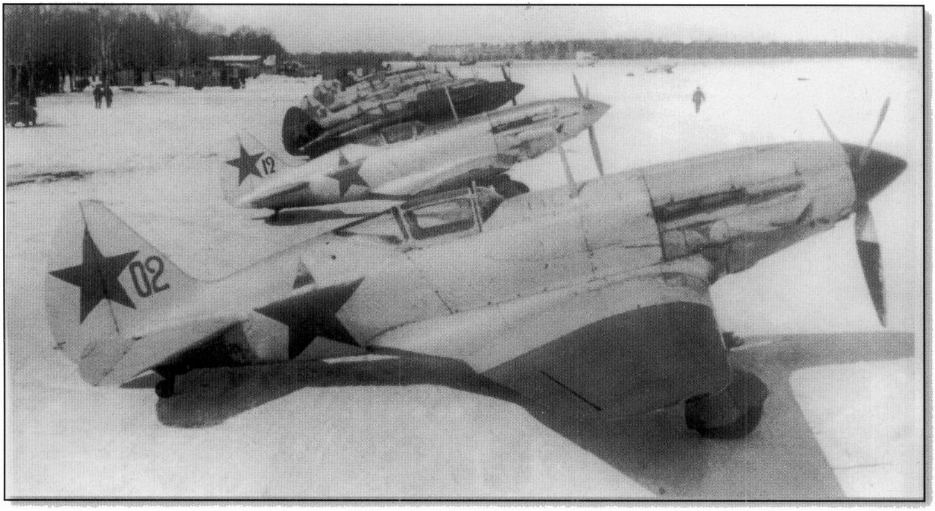
***Bottom**: All these MiG-3s belonged to 148 IAP, and the Pe-2s were from 99 BAP. Both regiments were from the RAG-4 (Rezervnaya Avia Grupa - Reserve Air Group).*

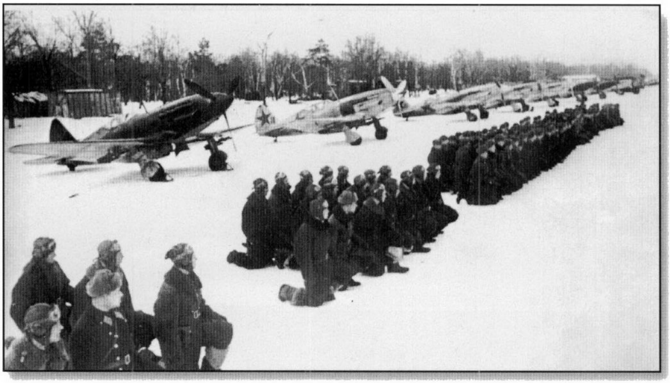


***Middle**: Another plane from 148 IAP. The prop blades are camouflaged white. Rockets are visible under the wing.*

***Bottom**: A line of planes from 148 IAP. Note that some have partial white camouflage, others have black engine cowlings.*

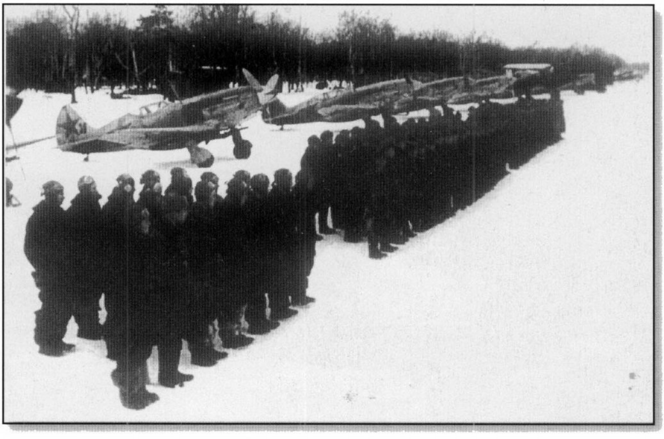






Top: *A line-up of MiG-3s at Vnukovo airfield. The photo was taken on March 7 1942, when 120 IAP of the Moscow Air Defence (PVO) was made a Guards Regiment, 12 GIAP, as a reward for its achievements. At this time, the fitters of 120 IAP were able to build many flyable MiG-3s from damaged planes. The line shows both white-painted and camouflaged aircraft, all armed with rocket launchers*

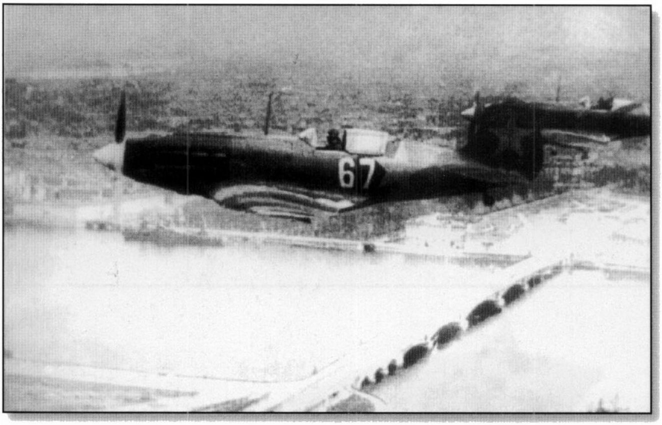
via K. Kulikov.



Two photos of the 120th IAP(fighter aviation regiment) of the Moscow PVO(anti-air defence), March 1942. Battle of Moscow.

via K. Kulikov

MiG-3s after the spring of 1942



MiG-3 fighters over Leningrad, 1941.

via V. Kulikov

After production ended in early 1942, the MiG-3 started to become rarer and rarer in operational units. On 1st May 1942 the VVS had 134 MiG-3s in its inventory, 75% of them combat ready.

During the battles of Kharkov, only 148th IAP, of many regiments involved, was equipped with MiG-3s.

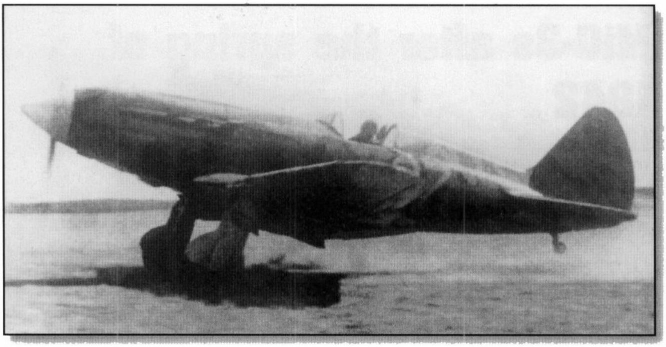
During the spring and summer, the MiG-3 was replaced by the Yak-1 and LaGG-3 in most units. Many of the remaining MiG-3s were delivered to 122 IAP commanded by Major G Bayandin. This unit continued to fly MiG-3s on bombers escort missions until the spring of 1943, by which time they were completely outclassed by the Fw190As of JG 51.

During 1942 and 1943 the MiG-3 operated mainly in Air Defence Units, where they fought against German bombers and reconnaissance plane up to altitudes of 11,000 m, but they were unable to reach the Ju86P and R, flying at more than 12,000 m.

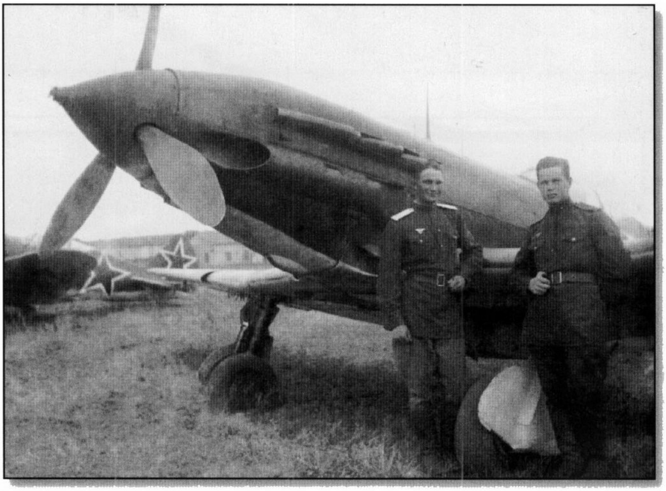
A limited number of MiG-3s were used for secondary duties, in second-line units, until the end of the war.

***Bottom right**: A.K. Niekliudov next to his aircraft; he served within 6th AK (Avia Corps) PVO of 1 VIA PVO (Vozdushnaya Istrebitelnaya Armiya: Air Fighter Army) in spring 1943.*
He saw action in Halkhin Gol, the Winter War and of course the GPW. He scored 7 victories.
Note the white bands on the wings, probably for quick identification.

***Left**: Another view of K.A.Kriukov and the same aircraft like in photo on the page 28.*

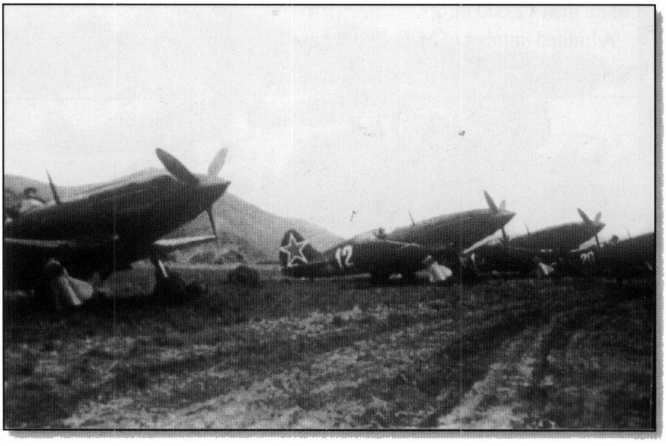


MiG-3 of 7th IAP, 1942, near Leningrad. The unusual camouflage is noteworthy



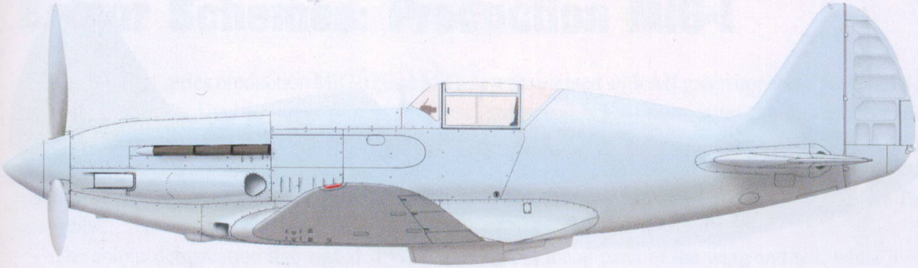
This photo was taken in the spring 1945; the old MiG-3s were still used for training ground crew. The man on the left is Ivan Ivanovich Zaicev (the owner of the picture), of 2 VVAShAM (Volskaya Voenaya Aviacionaya Shkola Aviamehanikov; Volsk Military Aviation School for air mechanics). The aircraft is a late example with slats, radio and starter dog. It was probably repainted with AMT green and light blue; the undercarriage looks dark. Note the stars with large white outlines. No number is visible.

Zaicev I.I. Archive

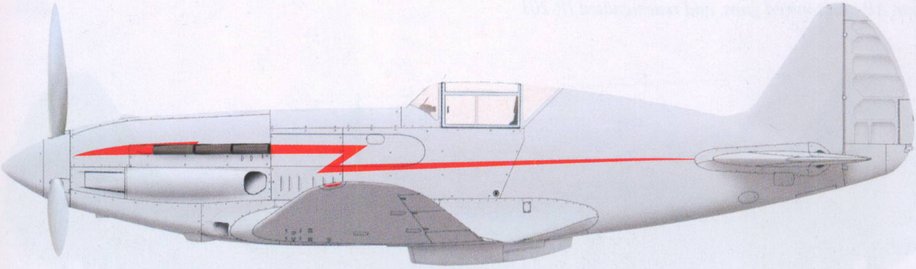


MiG-3s of the 7th IAD (fighter aviation division) of the Pacific fleet air forces. "Tsentral'naya Uzlovaya" airfield, August 1945.

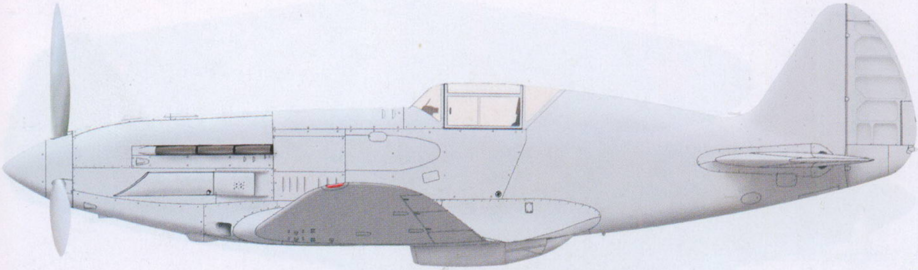
via V. Kulikov



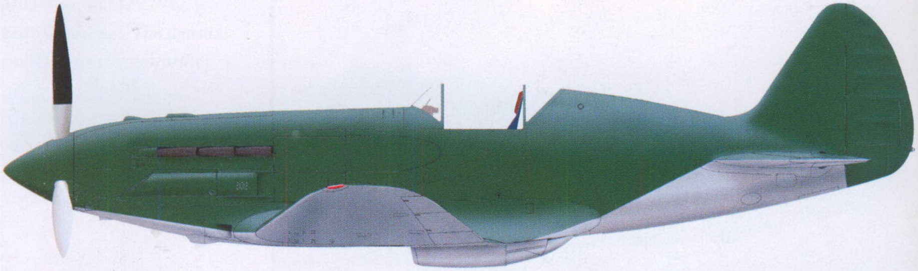
I-200 No.01; it was flown on April 1940 by test pilot Ekatov. It appears to be silver overall. At first, the oil cooler was on the left side only.



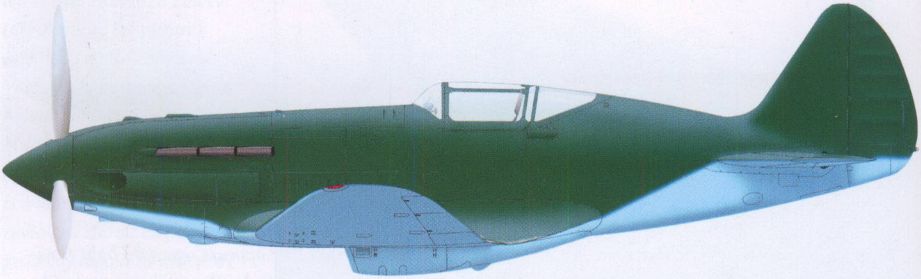
I-200 No.01 in April/May 1940 after some modifications to the oil cooler; the plane appears repainted light gloss grey with a red lightning bolt on each side. At the end, in August 1940, it was modified with a cooler on each side, shaped as on No.02 and 03.



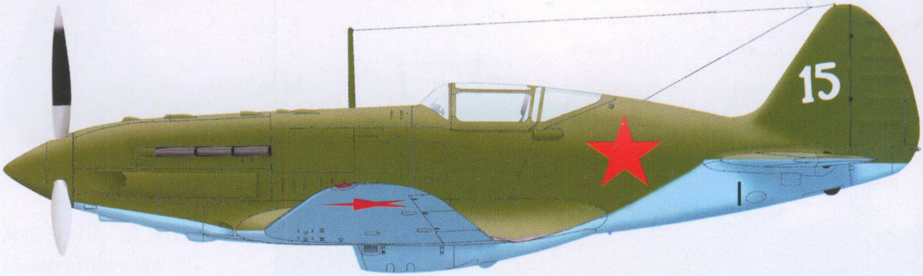
I-200 No.02, first flown by test pilot M.N. Yaskushin on May 9,1940.
It appears to have a light semi-gloss grey finish. It differed from No.01 by the oil coolers on both sides, the different radiator outlet and some small cooling slots and intakes added to the nose and sides.
It was later modified with an experimental AM-37 engine, and then crashed due to pilot error on May 1941.



I-200 n.03 was flown on June 6 by test pilot M.I. Martselyuk. It was the first prototype to be armed, and the only one to have metal outer wing panels. Its upper and side surfaces were painted gloss dark green (possibly the same shade as on the I-15bis), while the undersurfaces were painted aluminium. This plane was later fitted with a radio, aerial, and side-opening canopy. In late 1940, it was experimentally fitted with two wing MP-6 23 mm guns and two 12.7 mm AP syncronized guns, and redesignated IP-201.



I-200 n.04 (the MiG-3 prototype) flown by test pilot Ekatov in November 1940. It has the nose shape, size, cooling slots and tail wheel of production MiG-1s, but the landing gear, ventral radiator and tank as used on the MiG-3. It's painted gloss dark green, probably the same shade used on the I-15bis.



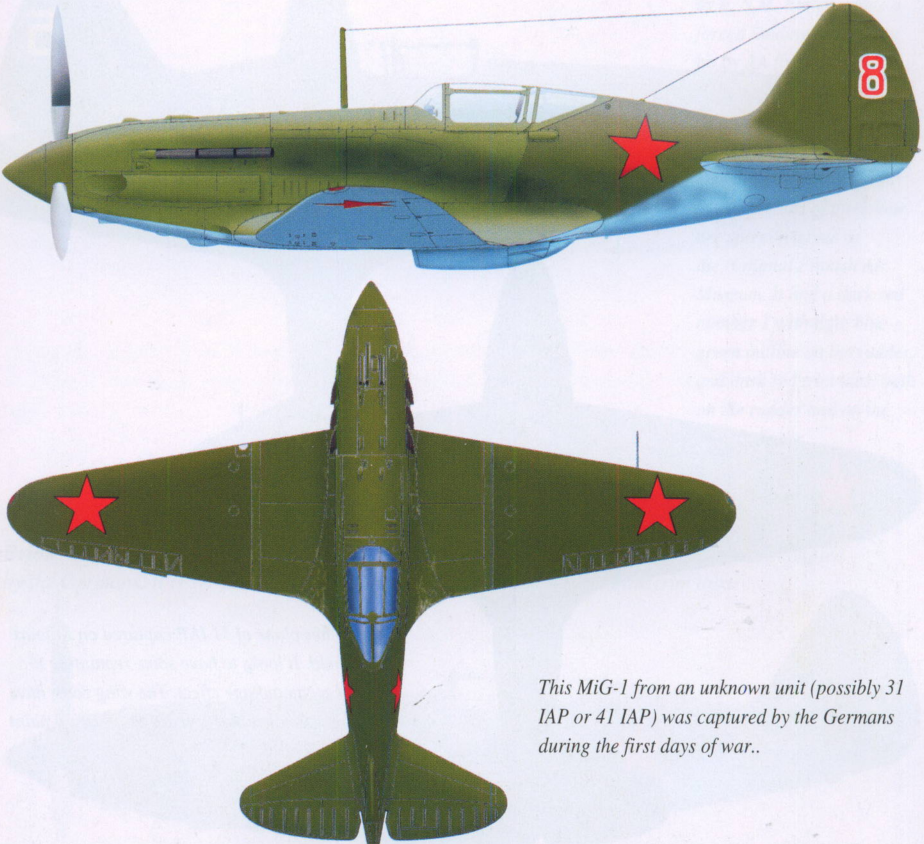
This early type MiG-3 No.2115 was used, alongside No.2107, for state tests at NII-VVS, the Scientific Institute of the Air Force, in January and February 1941. Production MiG-3s had a slightly longer nose than MiG-1s and I-200 No.04. Red stars were applied above and below the wings, and on the fuselage sides; this style of markings was abandoned at the outbreak of war.

Colour Schemes: Production MiG-1

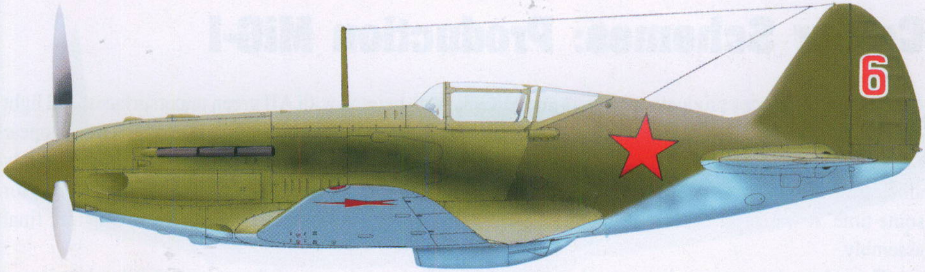
All the early series production MiG-1s and MiG-3s were painted with AII green uppersurfaces, and light blue undersurfaces. The metal surfaces (aft fuselage, horizontal tail surfaces, wing centre section) appear lighter and more worn than the wooden surfaces (rear fuselage, outer wing panels); this is visible on nearly all German photos, but not on Soviet ones. The difference appeared very marked in aircraft abandoned for some time. It was probably due to different painting techniques on separate sub-assemblies, before final assembly.

The colour demarcation line was sharp on the nose and metal parts of the wing and tail, while it was soft on wooden parts. The wooden and metal sections were painted before final assembly, as seen by the discontinuous demarcation lines at the junction of the separate assemblies.

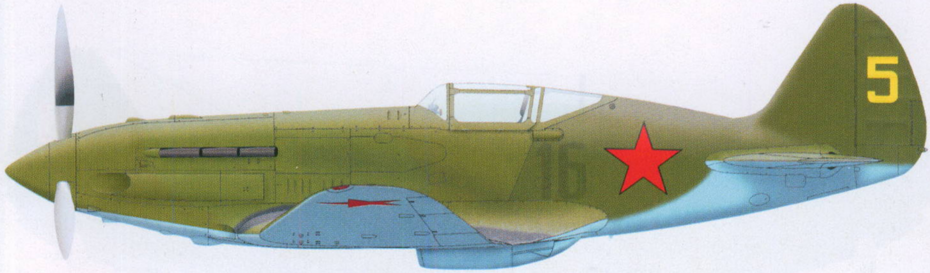
Red stars (often outlined in black) were applied to fuselage sides, and above and below the wings. The upper wing stars were removed early in the war. As standard, the propeller blades were unpainted aluminium, with partly black rear surfaces, often very worn. The pitot tube was light blue, with an unpainted aluminium end.

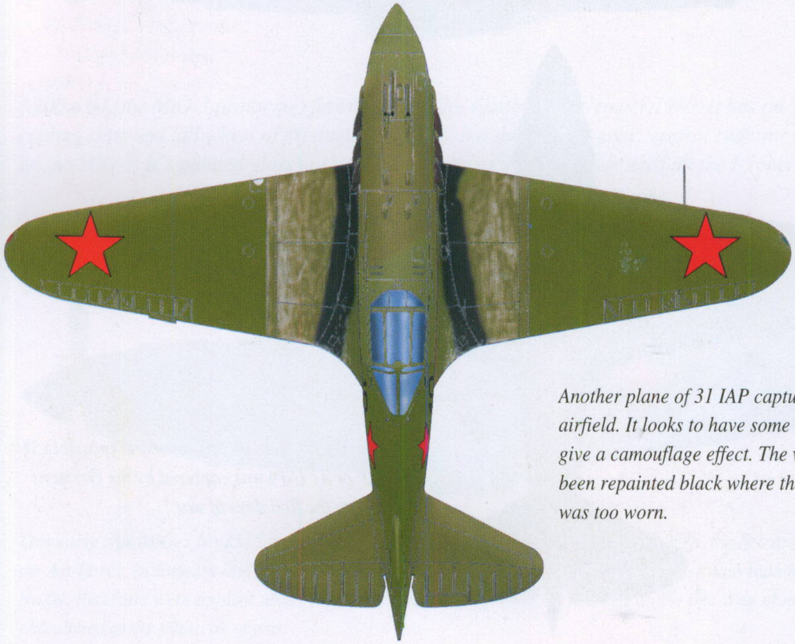


This MiG-1 from an unknown unit (possibly 31 IAP or 41 IAP) was captured by the Germans during the first days of war..



This aircraft is a production MiG-1 of 31 IAP; it was captured, with many other MiGs, on Kaunas airfield in Lithuania in the first days of war.

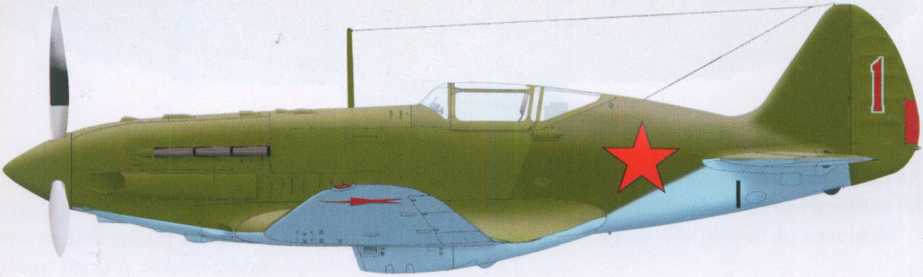


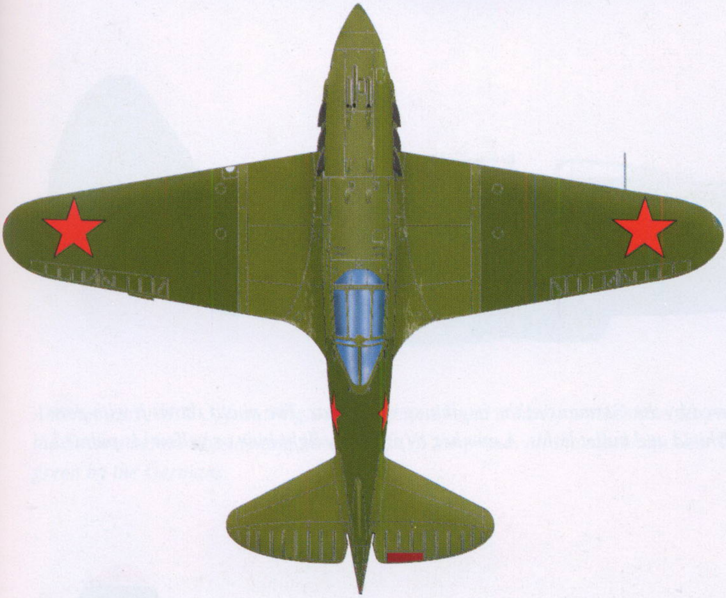


Another plane of 31 IAP captured on Kaunas airfield. It looks to have some repainting to give a camouflage effect. The wing roots have been repainted black where the original paint was too worn.

MiG-3 early scheme, to mid 1941

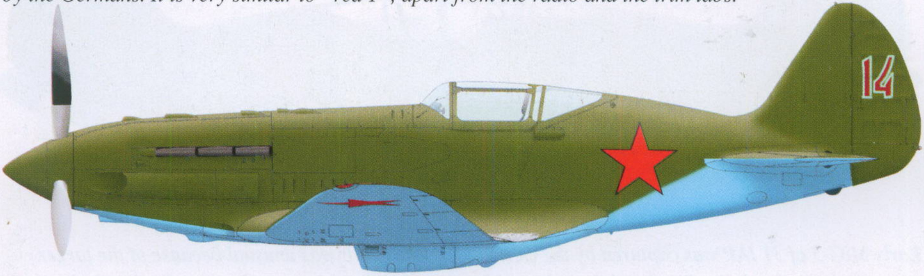
The first few hundred MiG-3s were painted with AII green and AII light blue, exactly as production MiG-1s. This scheme is known mostly from German photos of captured, downed or wrecked planes.

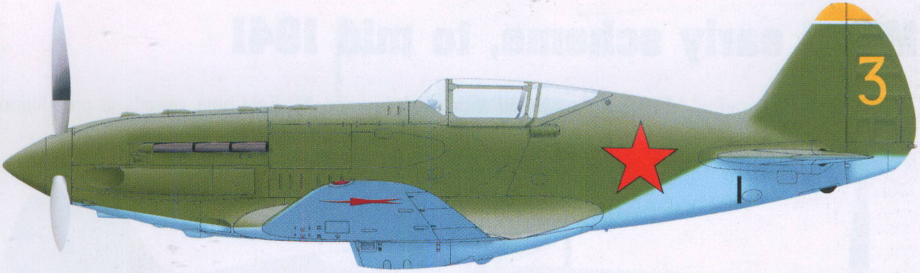




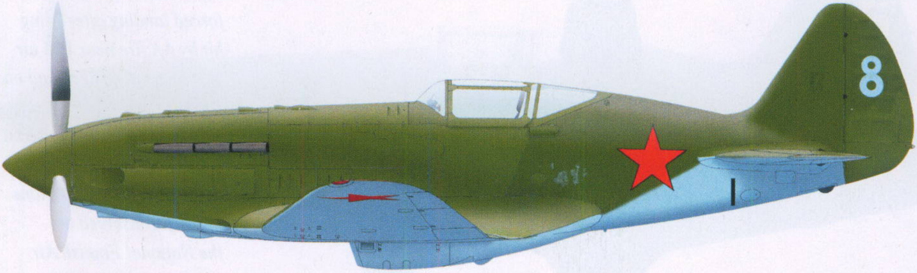
This early MiG-3, piloted by lt. N.M. Estyen, made a forced landing after being hit by AA fire near Utti air base in southern Finland on July 12, 1941. The unit was a detached fighter squadron (OIAE) of the Baltic fleet. Some remains of this plane are still conserved at the National Finnish Air Museum. It had a dark red number 1 with light blue-green outline on the rudder, and dark red trim tabs, both on the rudder and on the right elevator.

***Below**: This early MiG-3 of 31 IAP was photographed on Kaunas airfield in Lithuania, occupied by the Germans. It is very similar to "red 1", apart from the radio and the trim tabs.*

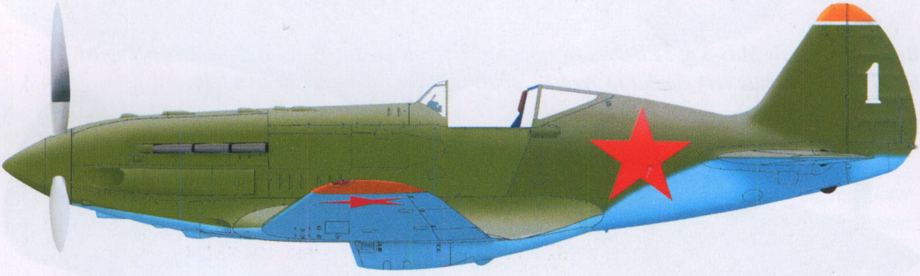




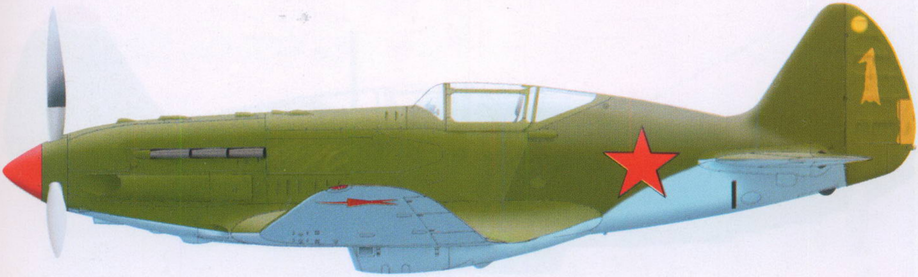
An early MiG-3 captured by the Germans at Kaunas air base at the beginning of the war. It has a yellow fin and number 3; there is a thin white stripe under the yellow stabilizer tip.



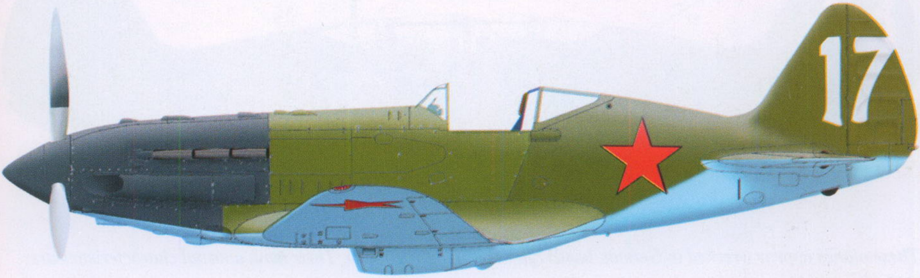
This early MiG-1 was captured by the Germans at the beginning of the war. The photo shows it with panels removed, a broken windshield and bullet holes. A number 8 (probably light blue or yellow) is painted on the rudder.



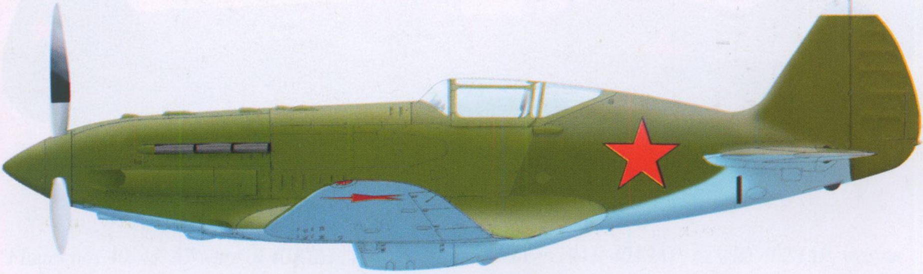
Early MiG-3 of 31 IAP was captured by the Germans at Kaunas. It was unusual because of the larger stars, the lack of a sliding hood and the coloured bands (possibly orange) at the tips of tail and wings.



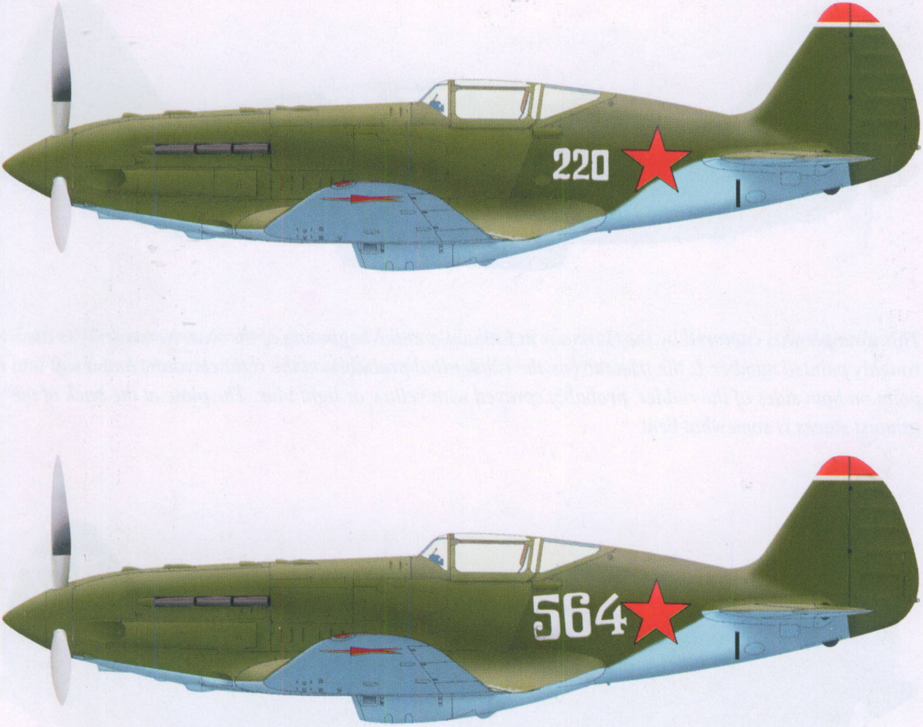
This example was captured by the Germans in Lithuania at the beginning of the war. Noteworthy is the roughly painted number 1, the trim tab (on the rudder and probably on the right elevator) and a soft point on both sides of the rudder, probably sprayed with yellow or light blue. The plate at the back of the exhaust stacks is somewhat bent.



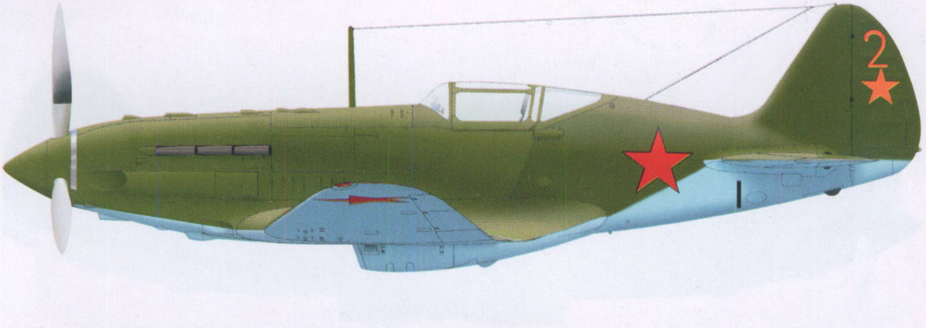
Another early MiG-3, featuring a large white 17 and a dark painted nose. Its propeller was broken by the Soviets before abandoning the aircraft. In the photo, all the markings have been roughly over-painted green by the Germans.



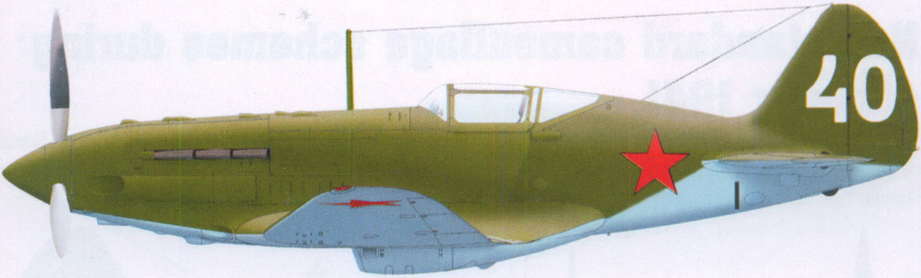
Another MiG-3, of unknown unit, captured by the Germans at the beginning of the war.

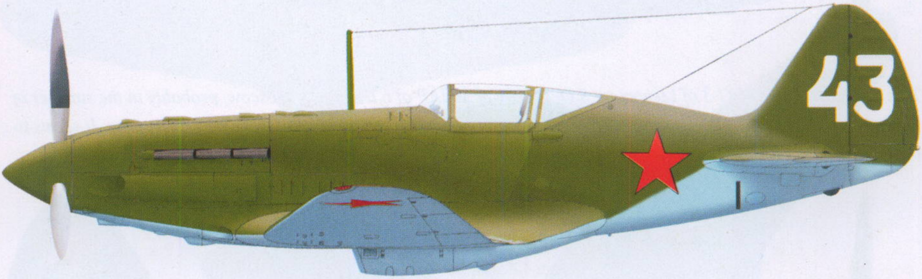


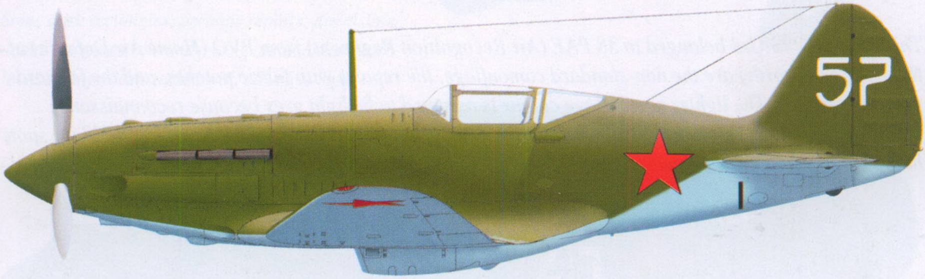
These planes appear wrecked in German hands after the first days of war. Their main unusual characteristics are their three-digits numbers on the fuselage.



A Ukrainian defector flew this MiG-3 to Melitopol airfield on 3 December 1941, surrendering to Rumanian troops. The plane was later re-marked and flown by the Rumanians. It wore a small star and a number painted in an unidentified light colour on its rudder. Despite being an old type, it had already the lip on the spinner and the triangular plates on the oil cooler outlets



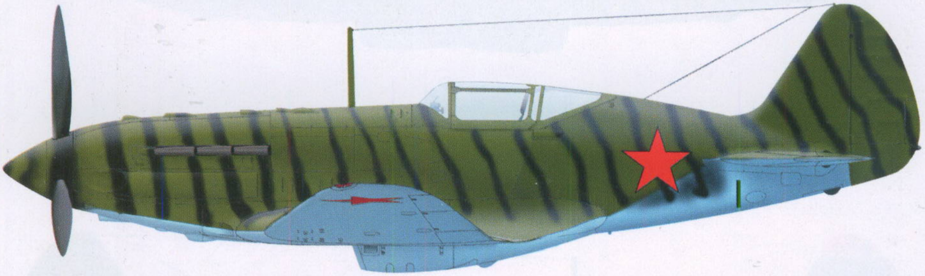




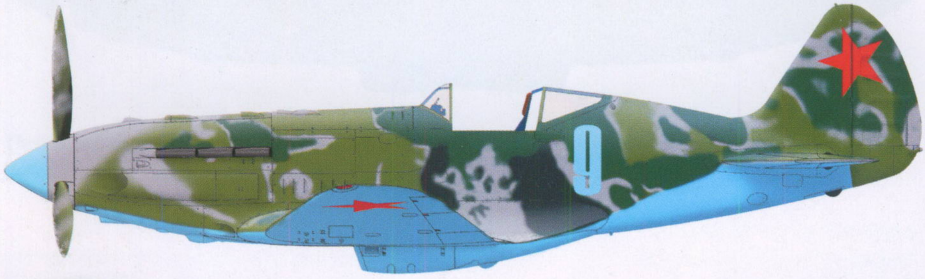
Planes nos.40, 43, 57 were of 401 IAP, Moscow front, summer 1941. 401 IAP, as with 402 IAP, was an elite unit formed by test pilots, that flew to the front on 30th June 1941. It was formed on the initiative of Hero of the Soviet Union Stepan Suprun, its first commander, who died in combat on 4 July 1941. Most of these aircraft were painted in the early green scheme, while some of them were over-painted with black bands. A movie shows them as operational, not captured or wrecked planes.

Non-standard camouflage schemes during summer 1941

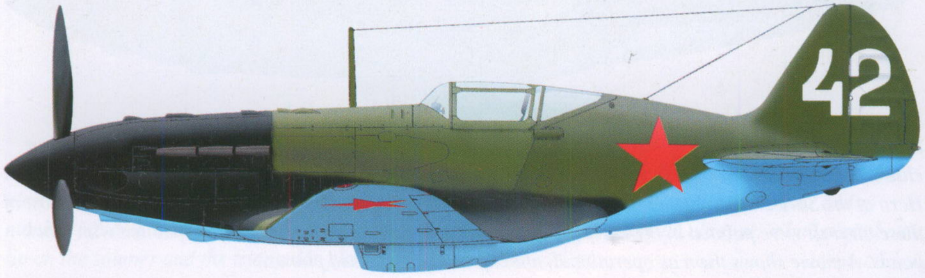
At the outbreak of war, disruptive camouflage became a standard practise in the Soviet air forces. Some early planes, surviving the first days of war, received non-standard camouflage painted over the pre-war standard green/blue livery.

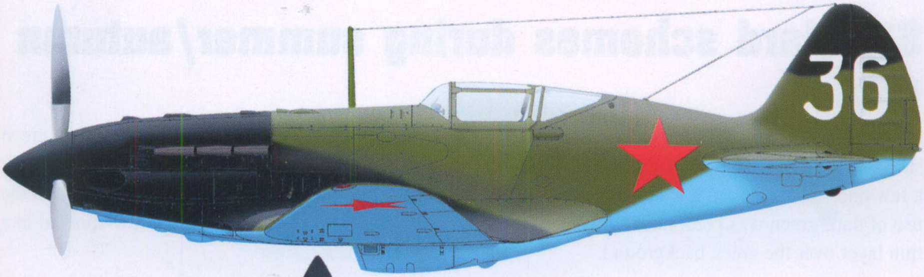


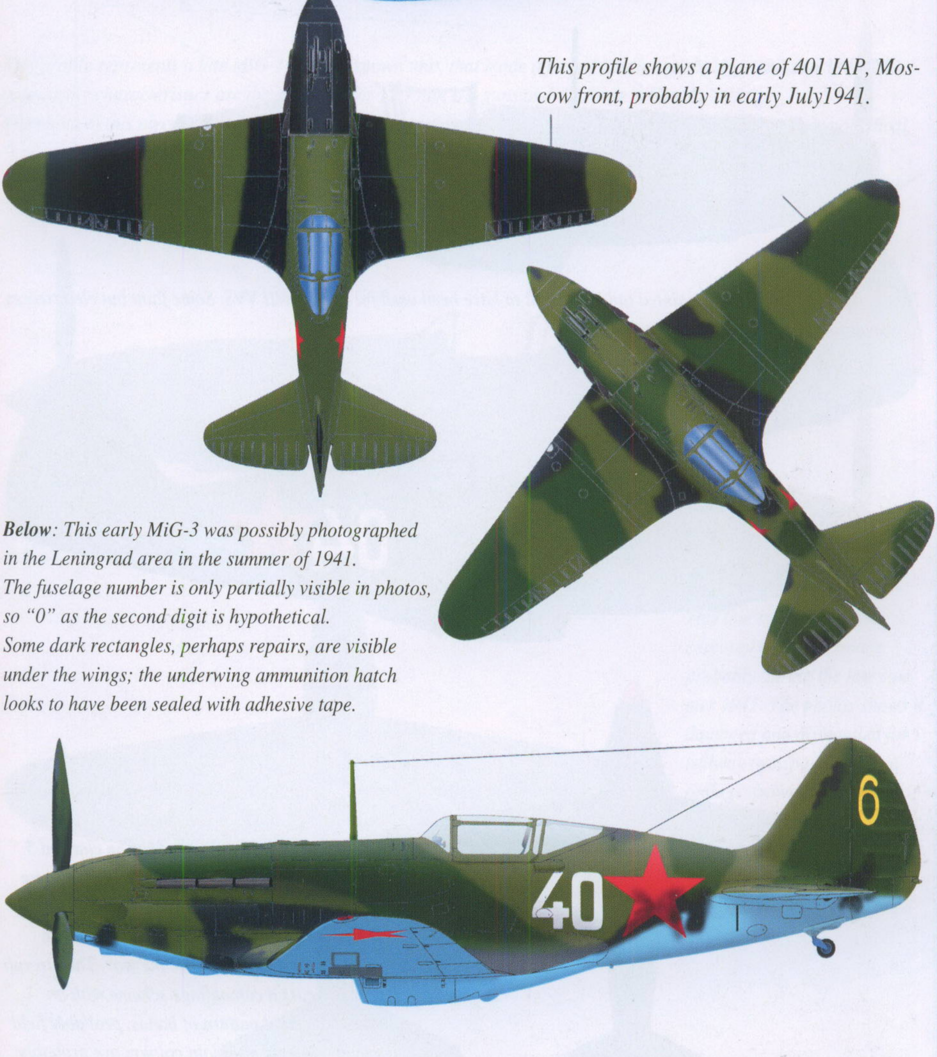
This is the early type MiG-3 of Lieutenant S.D. Baikov of 34 IAP of 6 IAK PVO, Moscow, probably in the summer of 1941. Although the aircraft is only partially visible in the photo, its camouflage appears very interesting. It seems to be a black zebra-like camouflage over an early overall green scheme. (The rear fuselage details are hypothetical).



This early type MiG-3 belonged to 38 PAE (Air Recognition Regiment) from PVO (Home Air Defence) of Moscow. Noteworthy are the non-standard camouflage, the repairs with fabric patches, and the forward-pointing red star. The lighter camouflage colour is assumed to be light grey because reconnaissance planes were often camouflaged with light colours. Sand is another possibility. Dark green and black spots have been applied over the base colour.







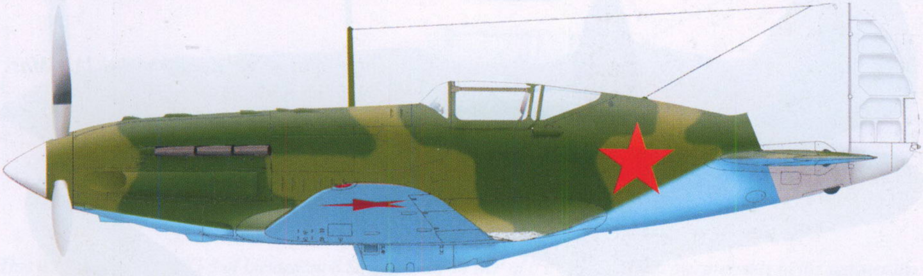
This profile shows a plane of 401 IAP, Moscow front, probably in early July1941.

Below*: This early MiG-3 was possibly photographed in the Leningrad area in the summer of 1941. The fuselage number is only partially visible in photos, so "0" as the second digit is hypothetical. Some dark rectangles, perhaps repairs, are visible under the wings; the underwing ammunition hatch looks to have been sealed with adhesive tape.*

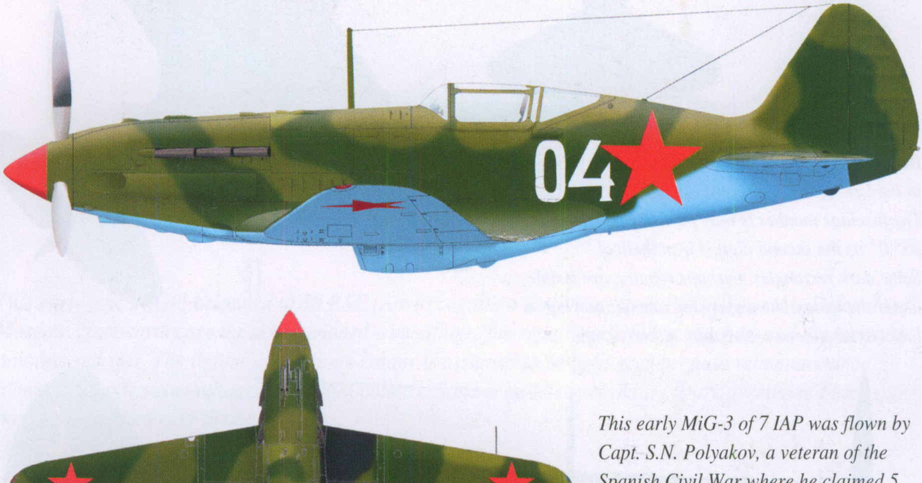
Opposite page, bottom: *Another plane of 401 IAP, "White 42", probably in early July 1941*

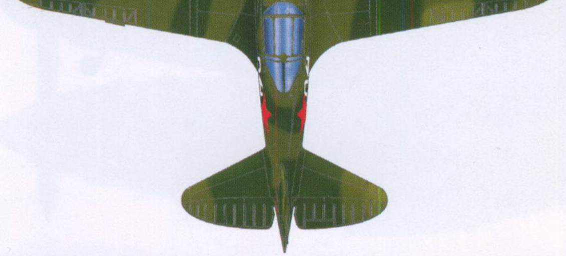
Standard schemes during summer/autumn 1941

Zavod 1 started to paint the MiG-3s with dark green or black camouflage bands over the standard green shortly before the outbreak of war. It's difficult to distinguish dark green from faded black in photos. Only a few photos show a strong contrast between the base green and the darker bands; this could mean that the use of dark green was predominant, or that black faded very quickly, or that black was over-sprayed in a thin layer over the green background.

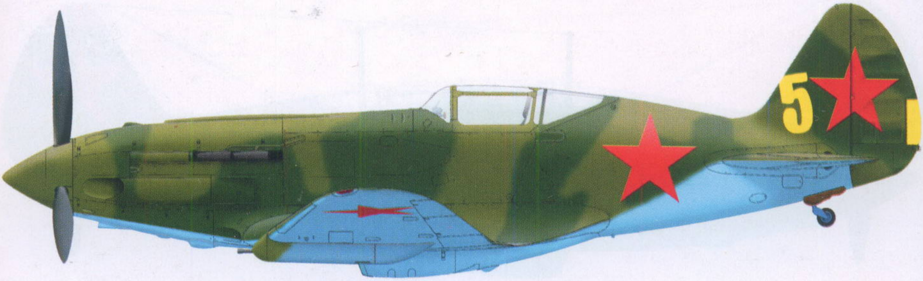


This early MiG-3 with white painted tail is thought to have been used for tests at NII VVS. Some faint but clear traces of camouflage are visible in photos.

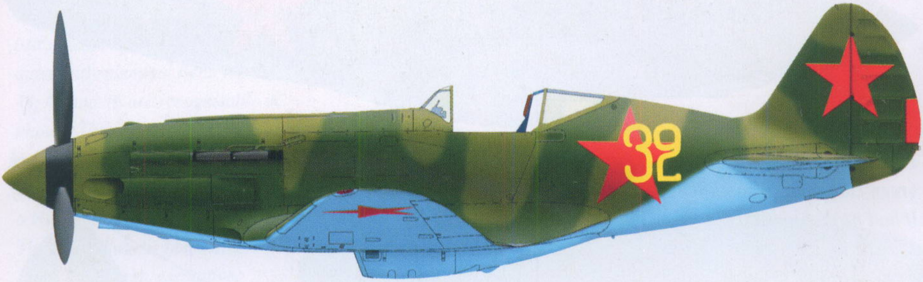


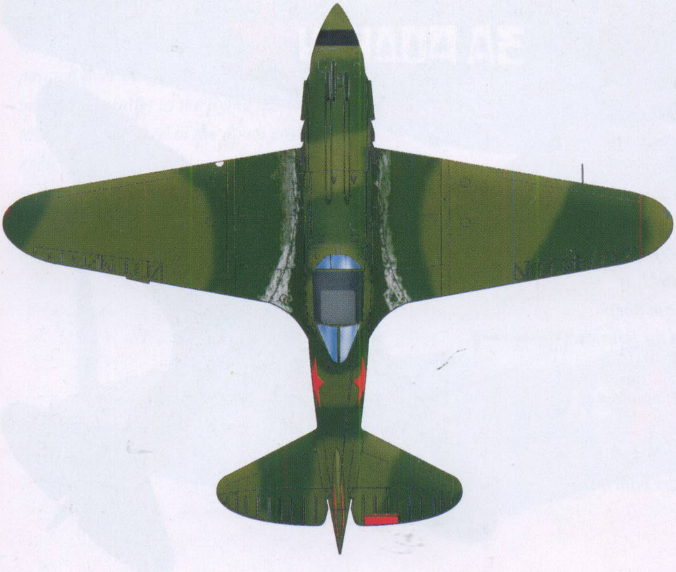


This early MiG-3 of 7 IAP was flown by Capt. S.N. Polyakov, a veteran of the Spanish Civil War where he claimed 5 victories. By June 1941 he had become deputy commander of 174 ShAP, so the photos of MiG-3 04 could have been taken shortly before the war. The aircraft bears a camouflage scheme with an unusual pattern of bands, probably field applied; the main colours are probably green and dark green, with some black and light green repainting.

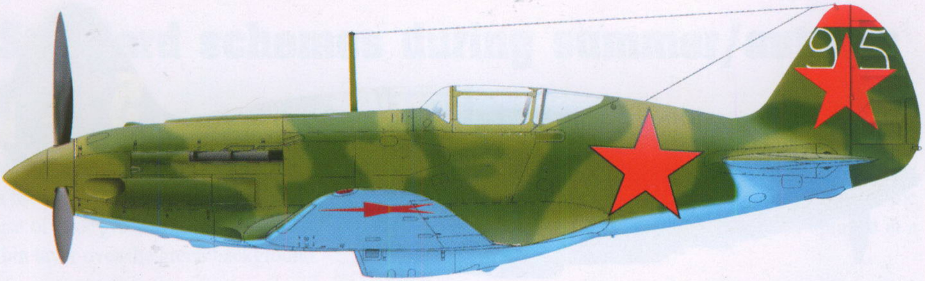


This profile represents a late MiG-3 of an unknown unit, that made a forced landing probably in autumn 1941. The noteworthy characteristics are the gun pods for 12.7 mm UB guns and the large yellow 5.
The photo of this aircraft has a very low contrast, and the reconstruction of the camouflage is partially hypothetical.

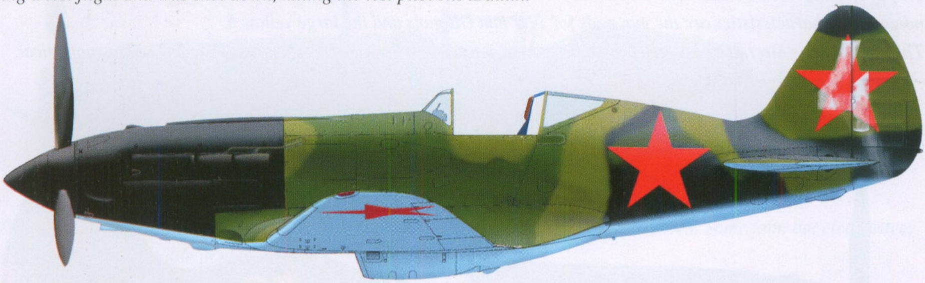




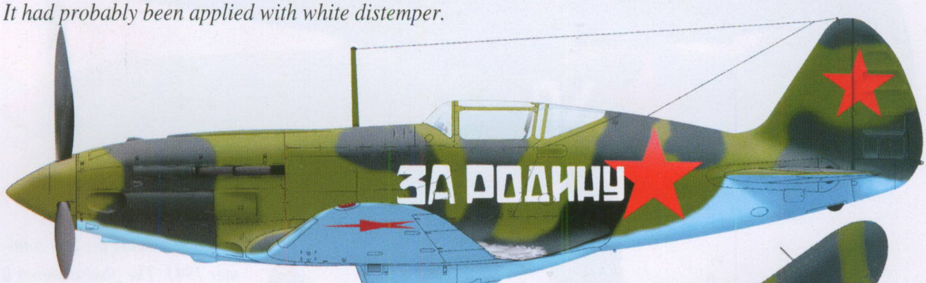
This late type MiG-3 was captured by the Germans, probably during the late summer 1941. The photos shows it damaged and dismantled for railway transport. The camouflage drawing is partially hypothetical, based on similar planes at this time.

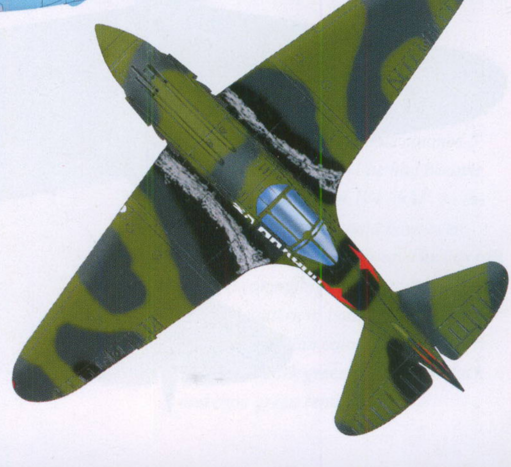


This is MiG-3 n.3595 experimentally fitted with the AM-38 engine in August 1941. It fought with enemy fighters during a test flight and was shot down, killing the test pilot N.P.Baulin.

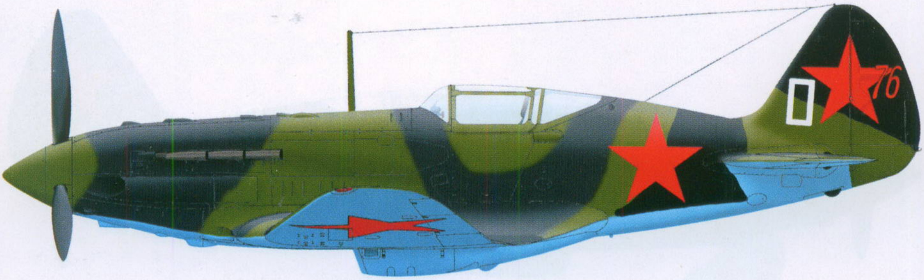


This is a late MiG-3 captured by the Germans, probably in 1942. It seems to wear a standard green/dark green camouflage, modified with black overspray. A large white 4 is visible on the tail, partly washed off. It had probably been applied with white distemper.



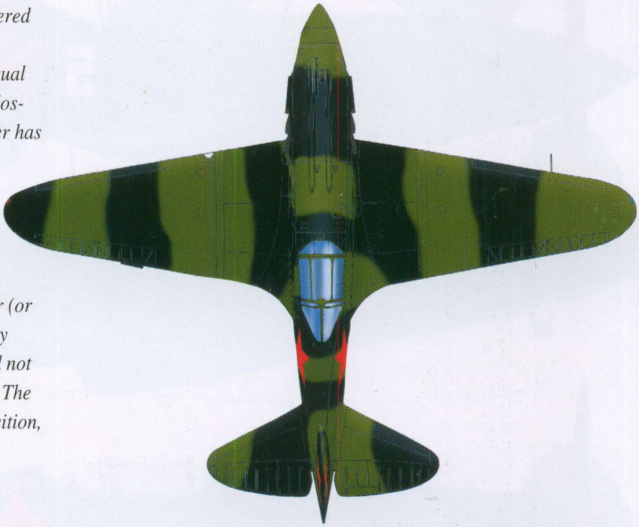


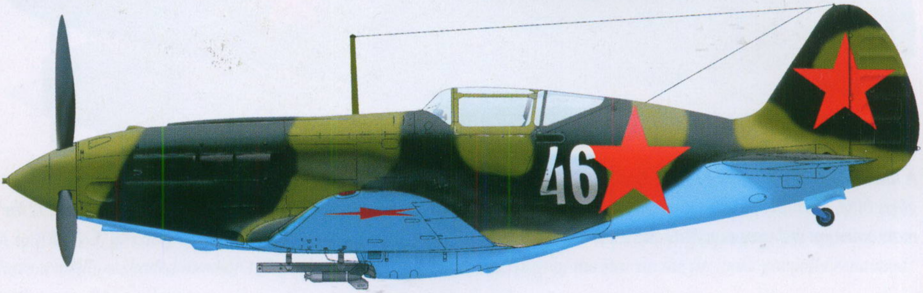
This late type MiG-3 was captured by the Germans, probably in autumn 1941. It features a "za rodinu" ("for the motherland") slogan, painted white on the left side, with decreasing digit size. The tail wheel doors are of the early type. The camouflage scheme has an unusual pattern.
Despite previous different interpretations, it is now known that it had red stars both on the fuselage and on the tail.

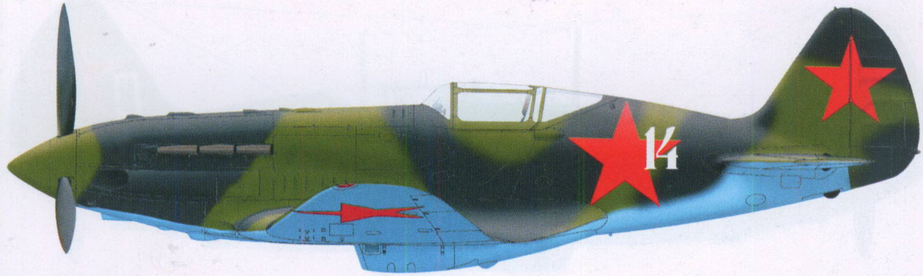


This early MiG-3 of Leytenant Kuznezov operated on the Moscow front. It featured slats on wings (not usual for early MIG-3s), main undercarriage covers cut away at the front, a red 76 with thin black outline partly over the tail star, a symbol (probably a 0 to designate the unit leader) on the fin, fresh handbrushed black over a green/faded black or dark green base camouflage.

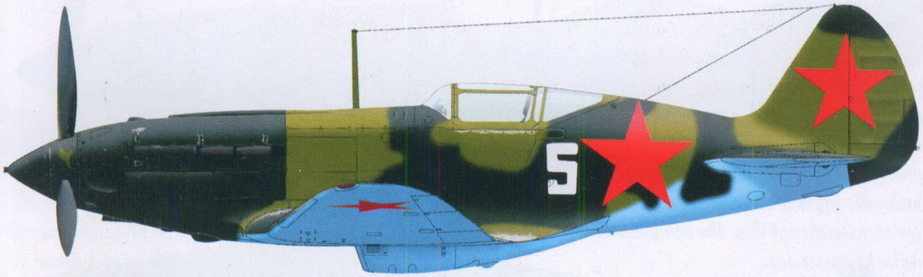
This late MiG-3 was from 6 IAK PVO (air defence of Moscow), 1941. Three apparently identical fighters, numbered 44, 45 and 46 are recognisable in photos. The rocket launchers are usual under the wings of MiG-3s of the Moscow Air Defence (PVO). The spinner has a Hucks starter dog.
The camouflage is black and green, and is representative, with small variants, of the scheme seen on many MiG-3s. The hand painted digits look to be silver (or white, darkened by smoke), partially painted over the fuselage stars, and not perfectly parallel to the flying axis. The tail wheel is locked in the down position, even in flight.



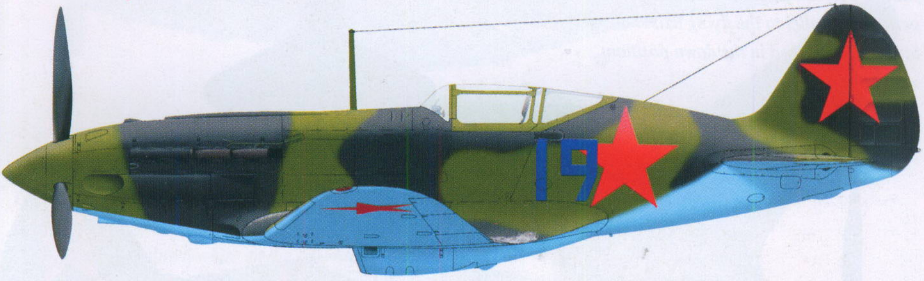




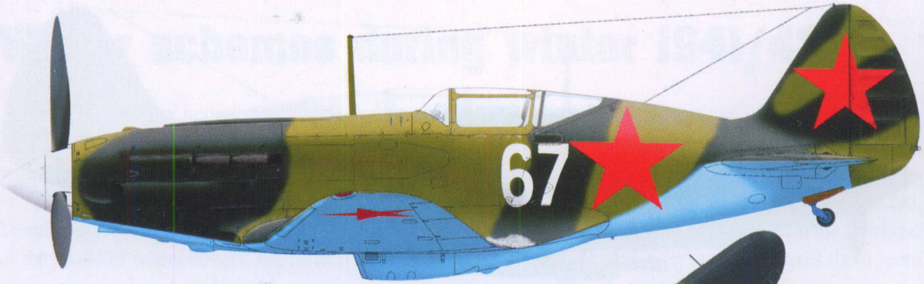
This early type MiG-3 was photographed alongside German soldiers in early 1942. Its camouflage is uncertain, because it is clearly visible only on the tail.



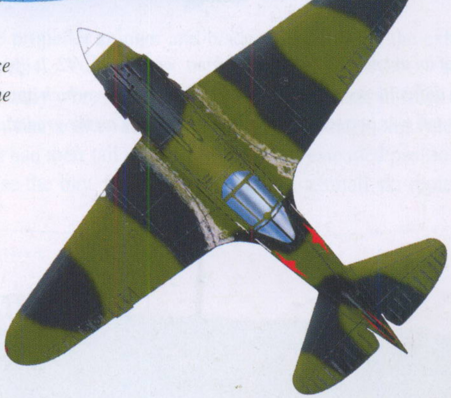
This late MiG-3 is a green and black camouflaged aircraft belonging to 8 IAP VVS Chf, Black Sea 1942. Note the starter attachment on the spinner. It has a standard paint scheme, except for the black repainting on the nose, propeller and sides.



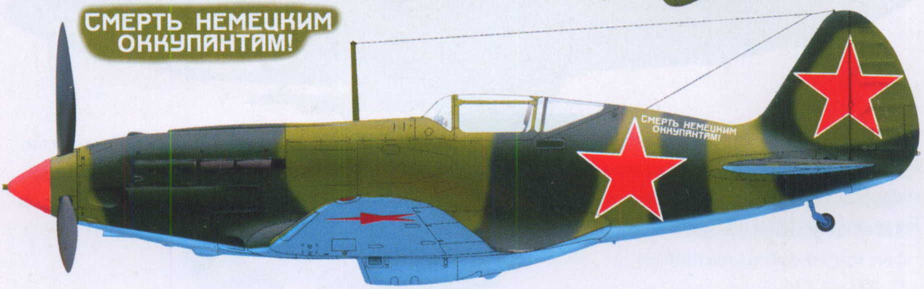
A late MiG-3 of 162 IAP, 43 IAD, Leningrad front, summer 1942. Noteworthy is the dark number 19, possibly dark gloss blue, partially painted over the star. The camouflage scheme on the wing, comprising longitudinal bands, is the most common style seen on MiG-3s.

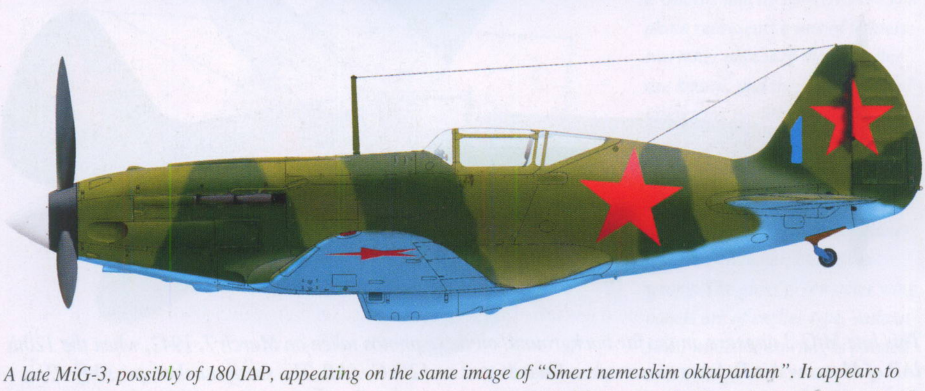


Late type MiG-3 of 7 IAK/PVO (the Air Defence of Leningrad), probably in spring 1942. Note the locked-down tail wheel.

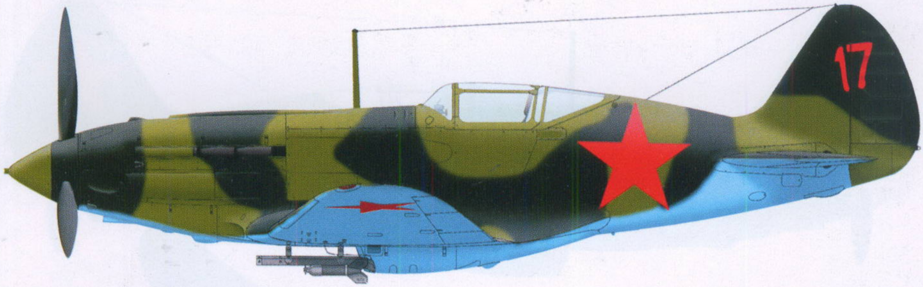


This late MiG-3 was possibly flown by S.Dolgushin of 180 IAP on the Moscow front. It was characterized by a slogan "Smert nemetskim okkupantam!" (death to the German occupants!), at least on the right side (here it's drawn on the left side too). Note the absence of tail wheel doors.

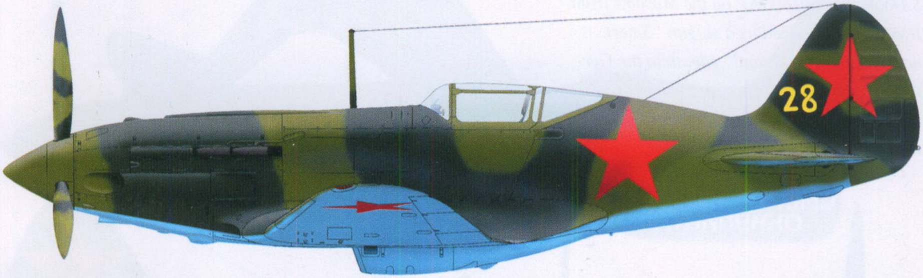

СМЕРТЬ НЕМЕЦКИМ
ОККУПАНТАМ!
СМЕРТЬ НЕМЕЦКИМ
ОККУПАНТАМ!



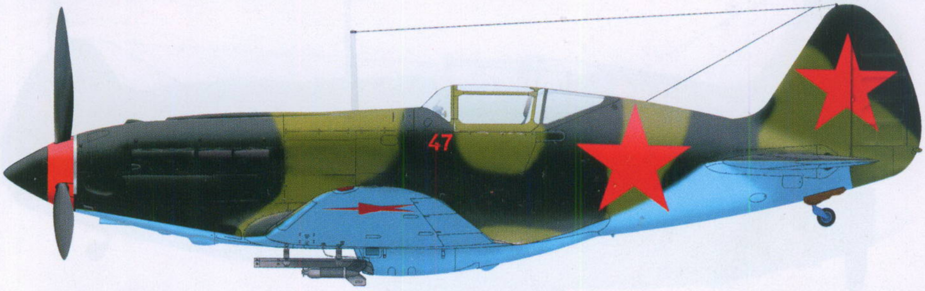
A late MiG-3, possibly of 180 IAP, appearing on the same image of "Smert nemetskim okkupantam". It appears to have a medium shaded number 1 (light blue or yellow) on its tail; part of the star on the fin looks partially repainted with camouflage colours.



Late MiG-3 of an unknown unit, Moscow front, winter 1941/42. It appears partially dismantled in the photo, and this creates some difficulty in drawing the camouflage scheme, which appears to have been partially field repainted. The red 17 on the tail was horizontal when the aircraft was on the ground.



This late MiG-3 was captured by the Germans, probably during autumn 1941. The rough number "28" was on the left side only. The photo shows that the aircraft is lacking wing panels, engine cowling, and canopy; the fuselage, rudder and landing gear appear damaged, perhaps from a bomb blast. Some camouflage is visible both on the landing gear doors (black and green soft dots on light blue) and propeller blades (black soft bands over green).



This late MiG-3 appears, in the far background, on three photos taken on March 7, 1942, when the 120th IAP of Moscow Air Defence was made a Guards unit as 12th Gv.IAP. The small number, possibly 47, is in an unusual position. On the photos two other summer camouflaged aircraft appear, but this is the only one with a partially red spinner. The prop blades were black, the antenna mast was white.

Winter schemes during winter 1941/42

During the snow period, many MiG-3 were painted white, both in the factory and in the field.

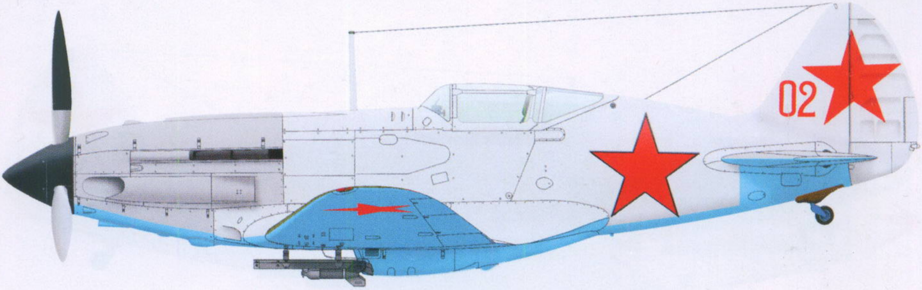
The white coat had a different look depending on the means of application (spray or brush), the thickness, wear, care by the ground crew, etc. In many cases, it appeared as a very light grey instead of pure white.

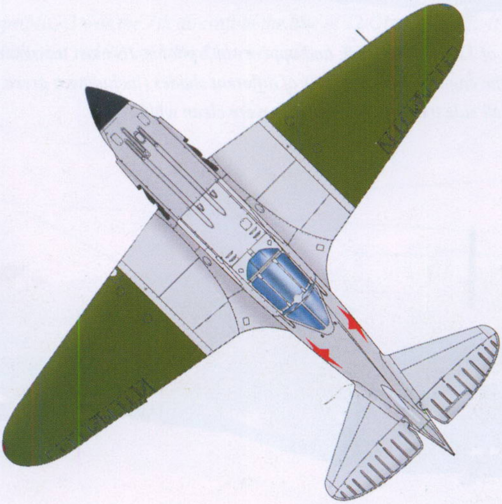
The white paint could cover the upper and side surfaces only, or be extended to the lower surfaces too. To distinguish this in photos, one has to check the presence of a white-blue demarcation line on the fuselage, or the shade of wheel covers; the reflection of light off the snow on wing under surfaces makes them seem white, even if they were light blue.

The white paint often extends onto the propeller spinner and blades, and even on the exhaust stacks (though heat quickly removes or discolours this).

While summer camouflaged MiG-3s usually wore numbers on the fuselage sides, in front of the stars, white MiG-3s wore them on the fin, or didn't have them at all. Very few exceptions to this rule were seen.

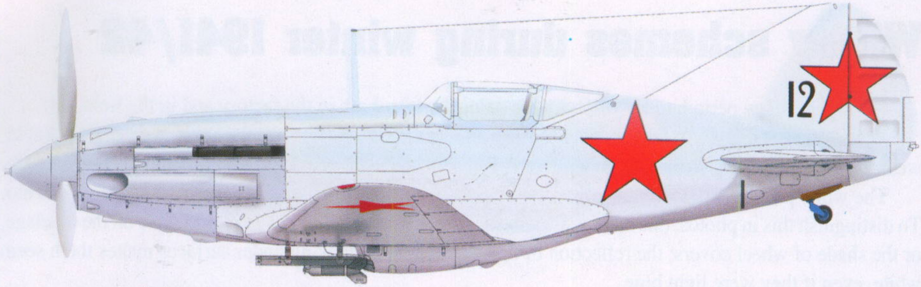
By the winter of 1941/42, most MiG-3s had their tail wheels locked in the extended position, the doors removed and a canvas cover added to close the bay. In one or two photos, a small ski replaces the tail wheel.



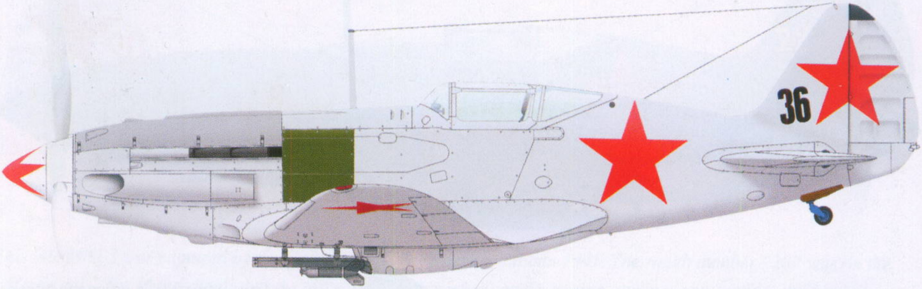


This aircraft is in a famous photo taken on March 7, 1942, at Vnukovo airport, when the 120th IAP of Moscow Air Defence was made a Guards unit as 12th Gv.IAP. The photo represents a line of fighters; two other photos of the same line are known, and they are a mine of interesting profiles.

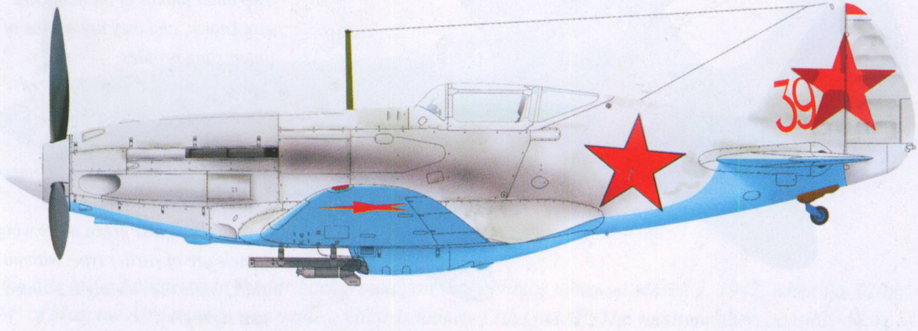
The first aircraft of the line, red 02, has often been interpreted as having red outer wing panels, silver engine cowling, red spinner and black number, but this is wrong. The gloss green outer wing panels are of earlier type, without slats, while the cowling is painted in a light grey.



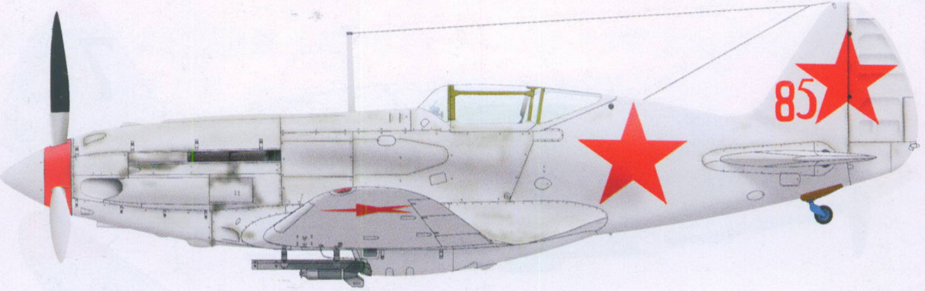
Black 12 is the second MiG-3 in the line. It's a late type MiG-3, with slats and starter dog. Its unique characteristic is that its nose, canopy frame and perhaps its lower surfaces, at least the fuselage, were painted silver; compared to the white-painted aircraft it is unusually reflective. It could be a thin gloss white layer on a silver background. The use of silver paint under the wings is not certain. According to some unconfirmed sources, this aircraft was flown by S. Rubtzov.



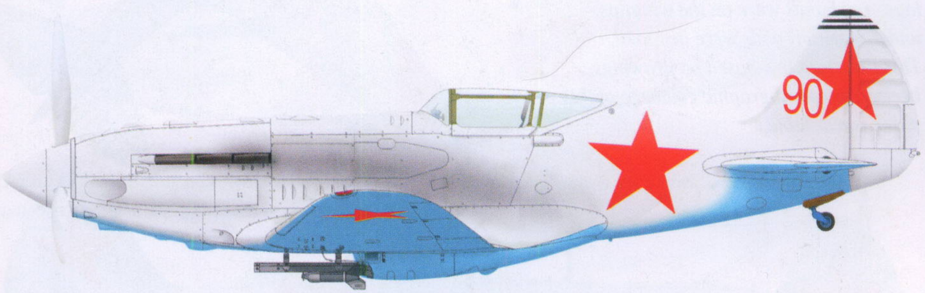
This late type MiG-3 is the 4th of the line of 12 GIAP aircraft, and appears in 2 photos. Its most interesting characteristics are the star on the spinner, and the engine cowling panels of different shades (including a green one, at least on the right side; here it's drawn on the left side too). The prop blades were clean white.



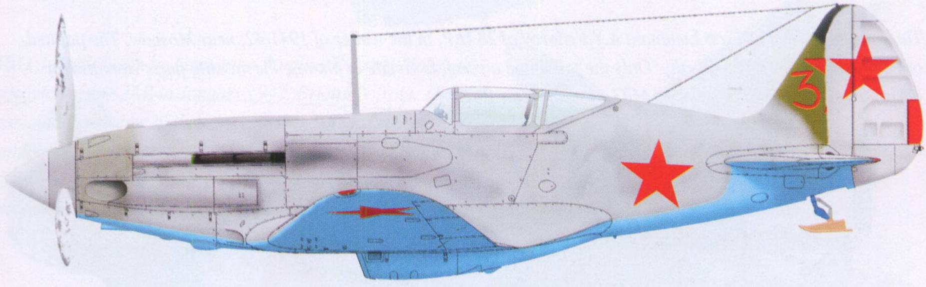
This late MiG-3 is the 5th in the line of 12 GIAP aircraft. The front of the spinner is fresh white paint, while the rear part, and the upper and side surfaces of the aircraft, were well-worn white.



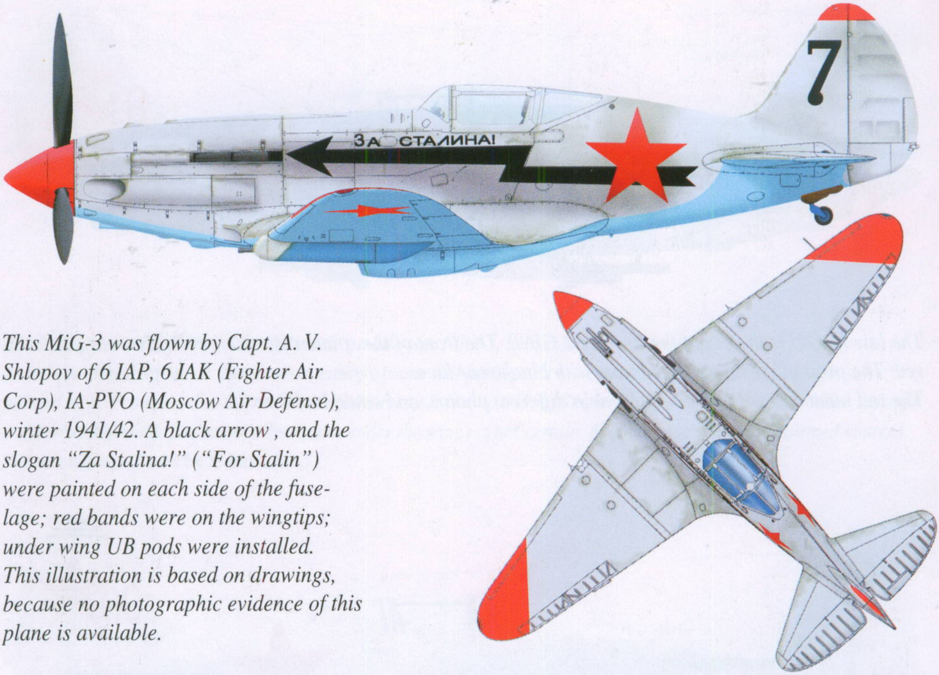
The late MiG-3 is the 6th of the line of 12 GIAP. The front of the spinner is white, while the rear part was red. The prop blades were aluminium with black rear face.
The tail number appear a bit different in different photos, and could be 05 or 85.



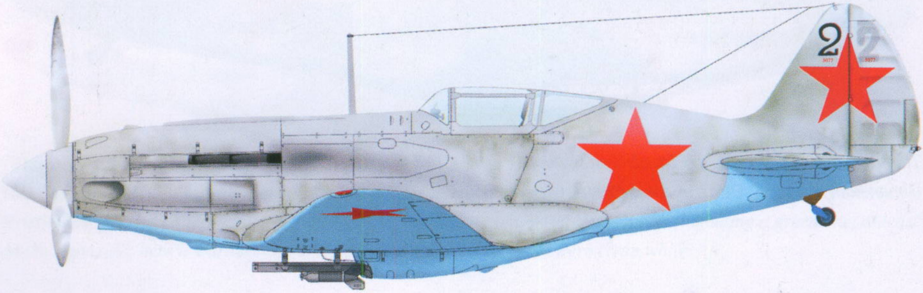
This early type MiG-3 was the 7th aircraft in the line of 12 GIAP aircraft. It was characterised by a clean white finish, an oddly aligned red 90, and three black bands.



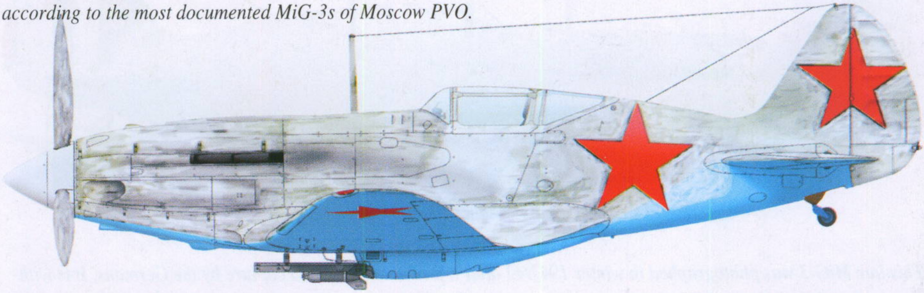
This late MiG-3 was photographed in winter 1941/42 after a forced landing, and capture by the Germans. It is without slats, and the tail wheel looks to have been replaced by a ski. It is painted with an irregular white coat that lets us see a part of the fin where a rough 3 was painted. Trim tabs on the rudder and on the right elevator are red.



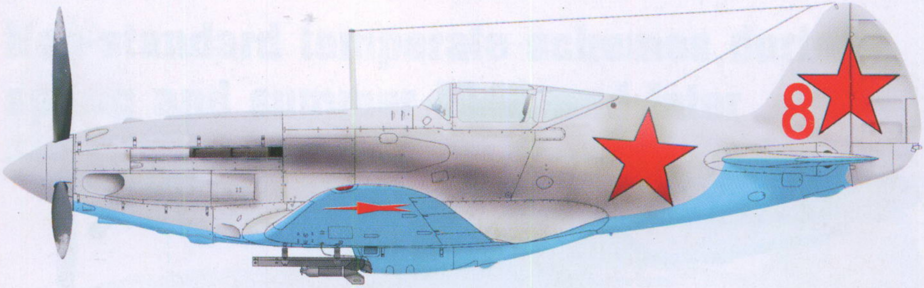
This MiG-3 was flown by Capt. A. V. Shlopov of 6 IAP, 6 IAK (Fighter Air Corp), IA-PVO (Moscow Air Defense), winter 1941/42. A black arrow , and the slogan "Za Stalina!" ("For Stalin") were painted on each side of the fuselage; red bands were on the wingtips; under wing UB pods were installed. This illustration is based on drawings, because no photographic evidence of this plane is available.



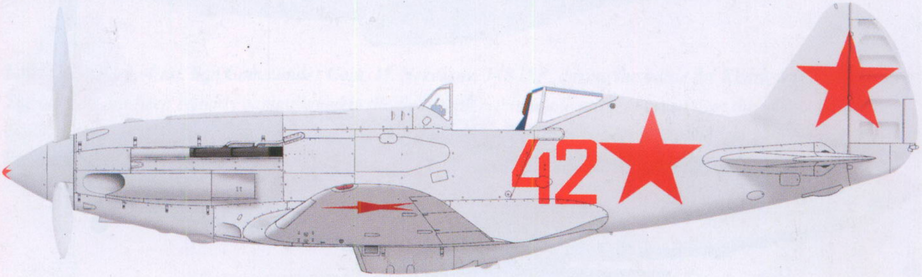
This was the MiG-3 of First Lieutenant A.Y.Fedorov of 28 IAP, in the winter of 1941/42, near Moscow. The painted-out 2 on the rudder is noteworthy. Only the tail of the aircraft is visible in photos; the missing parts were drawn according to the most documented MiG-3s of Moscow PVO.



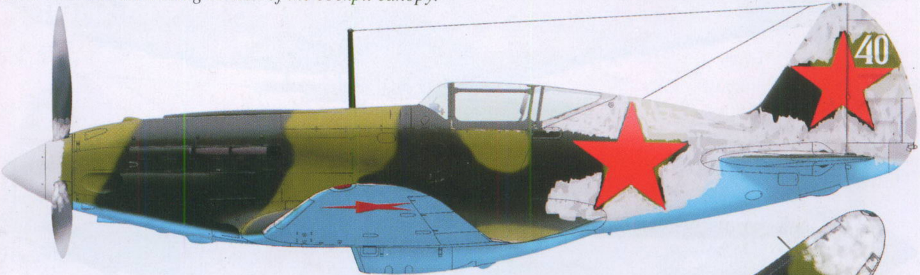
This late type MiG-3 was photographed on the Kalininsky front, winter 1941/42. The traces of hand brush painting are evident. The red stars are irregularly contoured.

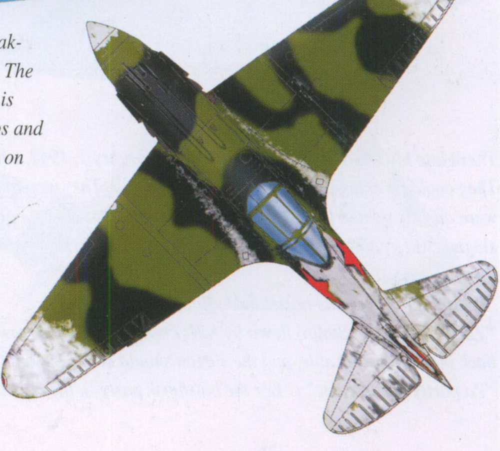


This late MiG-3 is that of V.Matakov from 27 IAP, 6 IAK PVO, Moscow Defence during winter 1941/42. The tail wheel was retractable; the prop blades were black with roughly painted white tips, while the spinner, not visible in photos, might be white. It probably had under wing rockets, as on many MiGs of Moscow PVO.

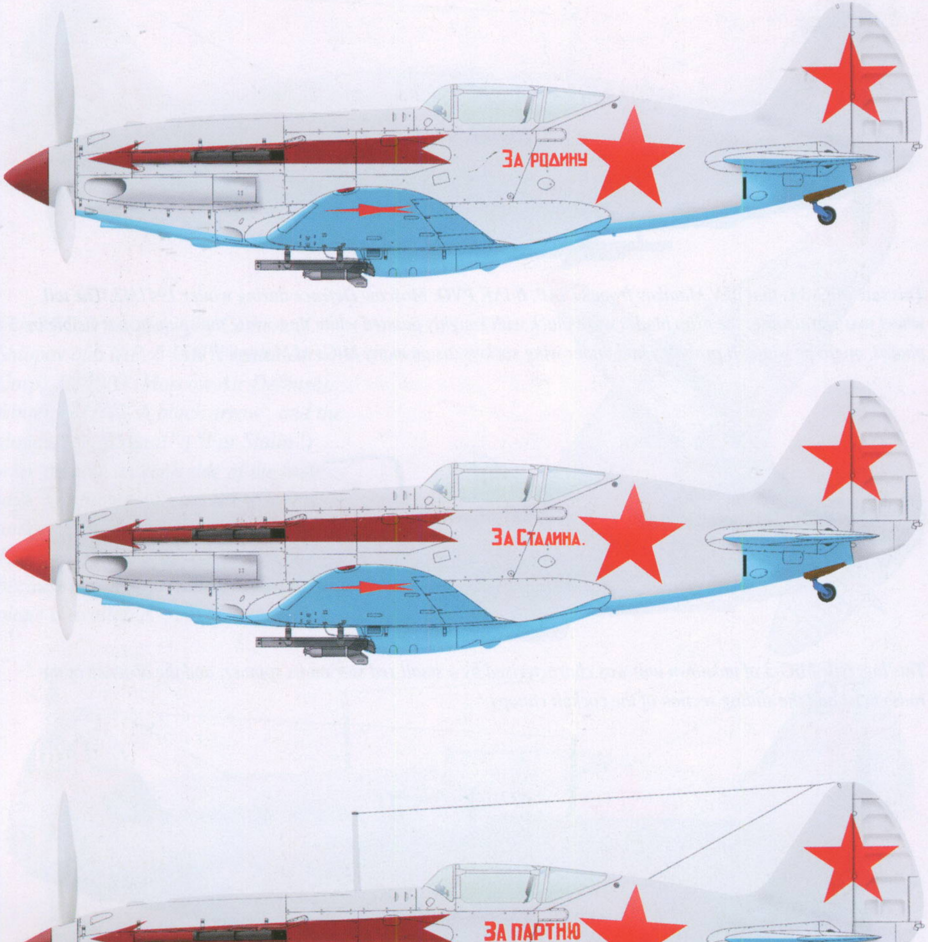


This late type MiG-3 of unknown unit was characterised by a small red star on its spinner, and the absence of the radio mast and the sliding section of the cockpit canopy.



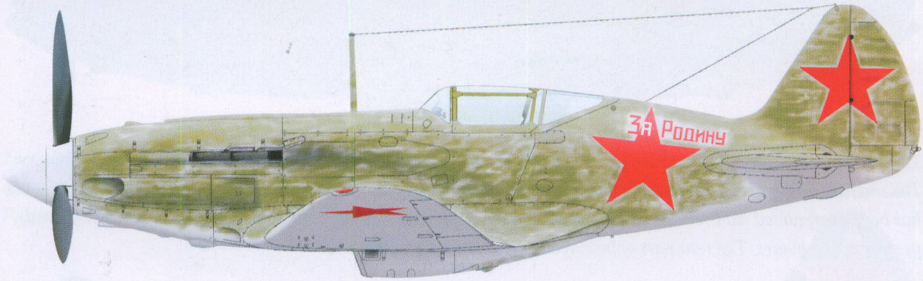


MiG-3 Nr.40 flown by Lieutenant Panfilov Evgenyi Maksimovich of 148 IAP in January 1942, Brianskiy front. The camouflage scheme of the wings, from what is visible, is somewhat strange and due to field repainting. Wingtips and the left side are not visible on photos, and were drawn on the basis of other planes of the same unit.

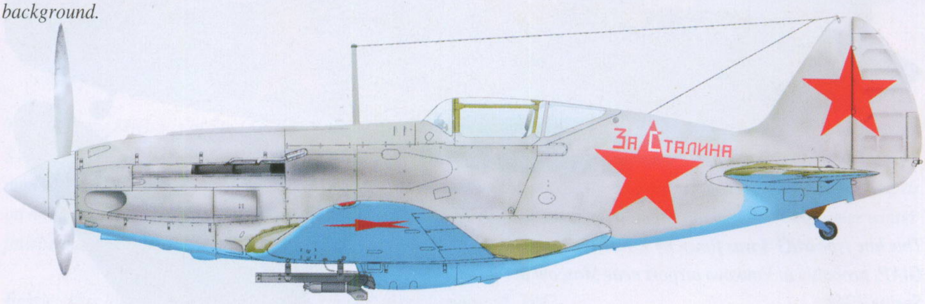


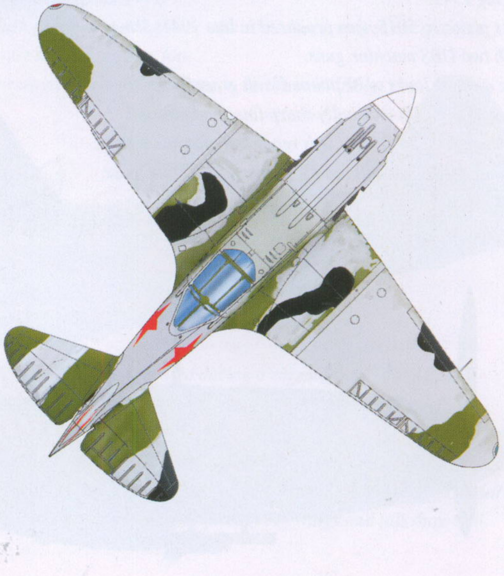
These late MiG-3s were photographed on February 1, 1942, when they were delivered to 172 IAP during a ceremony. They could be amongst the last MiG-3s ever built. They were probably armed with 2 x ShVAK 20 mm guns. They were quickly passed to 122 IAP, that utilised them as escort fighters until 1943. The white surface is immaculate; the slogans were painted on both sides, as were the red arrows. The prop blades were white too.
The slogans are:
"Za rodinu" ("For the homeland") flown by D. Latyshev.
"Za Stalina" (For Stalin) flown by A.K. Popov (note: the arrow on the right side should end about 20 cm further back than on the left side, and the slogan should be moved a bit backward)
"Za partiy bolshevikov" ("For the bolshevik party"), the only one equipped with radio.

Non-standard temperate schemes during spring and summer 1942 and later

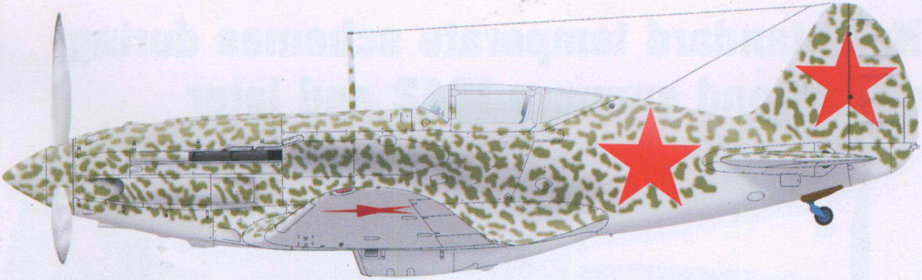


Late type MiG-3 of 1st. Sqn Commander Capt. M. Nekrasov, 148 IAP, during the battle for Kharkov in 1942. The aircraft has been roughly camouflaged in the field, with a thin application of green over the winter finish. The slogan Za Rodinu (for the Motherland) is painted in red on the white background, and white on the red star background.

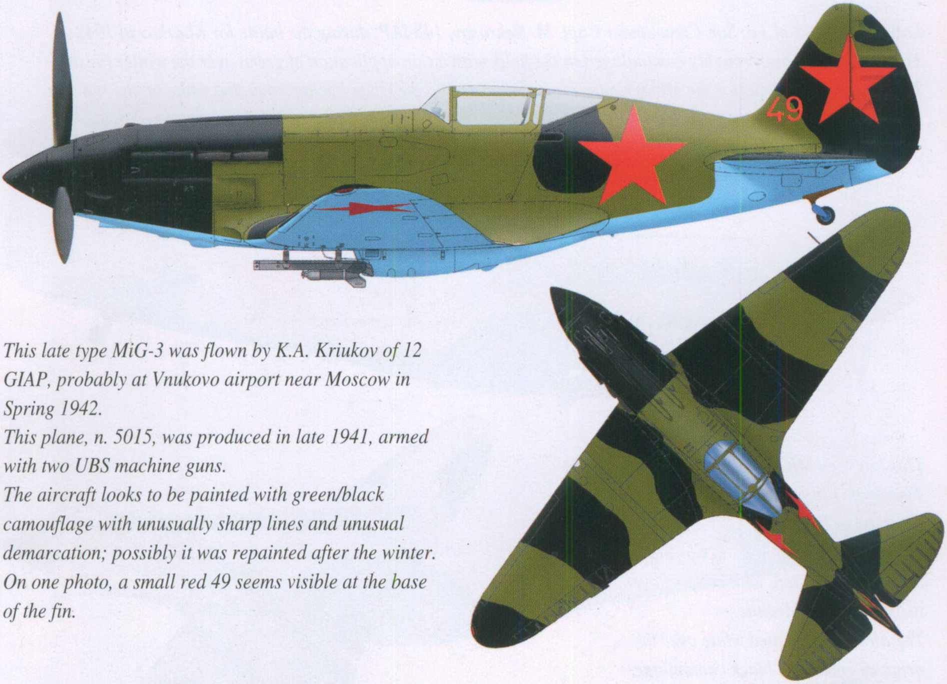




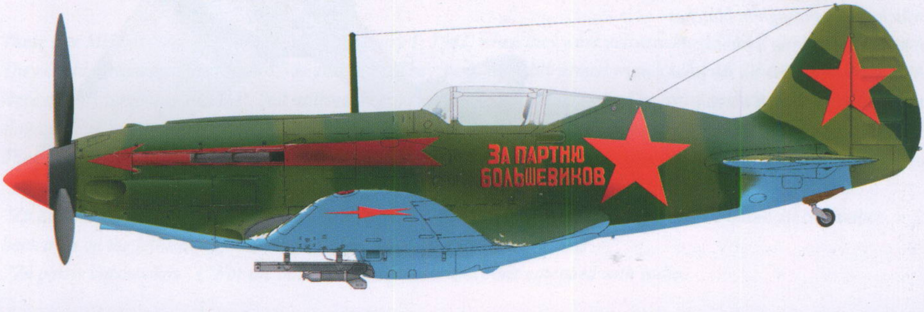
This late type MiG-3 was flown by maj. Yakov Titayevof, 148 IAP, during the battle for Kharkov in 1942.
The slogan "Za Stalina" ("For Stalin") is painted red, with the part over the star repainted white.
The aircraft is painted white over the original green and black camouflage, which shows through in blotches (partially visible on a photo).
No number is visible on the photo, but there could be one on the tail.
The small triangular plates near the side oil cooler exhaust flap seem to be missing.

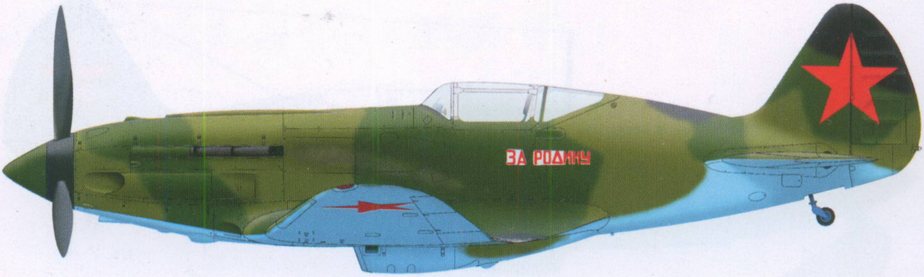


This image represents a late type MiG-3 of 148 IAP during the battle for Kharkov in 1942. The aircraft, originally white overall (including undercarriage legs and doors, while the wheel disk remained green), has been overpainted with very small green spots on the upper and side surfaces, including wings and spinner and, perhaps, prop blades. The rear part of fuselage is not visible in the photo.

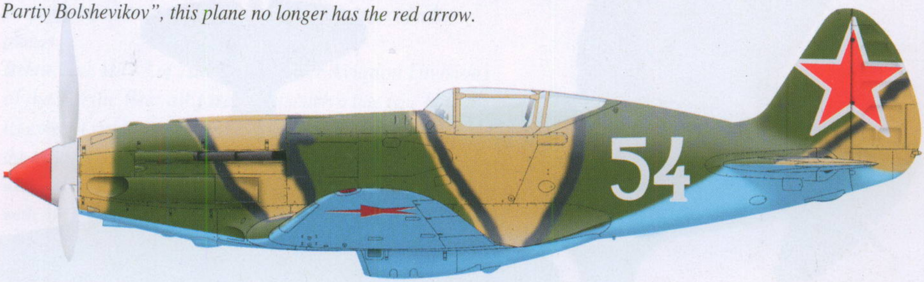


This late type MiG-3 was flown by K.A. Kriukov of 12 GIAP, probably at Vnukovo airport near Moscow in Spring 1942.
This plane, n. 5015, was produced in late 1941, armed with two UBS machine guns.
The aircraft looks to be painted with green/black camouflage with unusually sharp lines and unusual demarcation; possibly it was repainted after the winter.
On one photo, a small red 49 seems visible at the base of the fin.



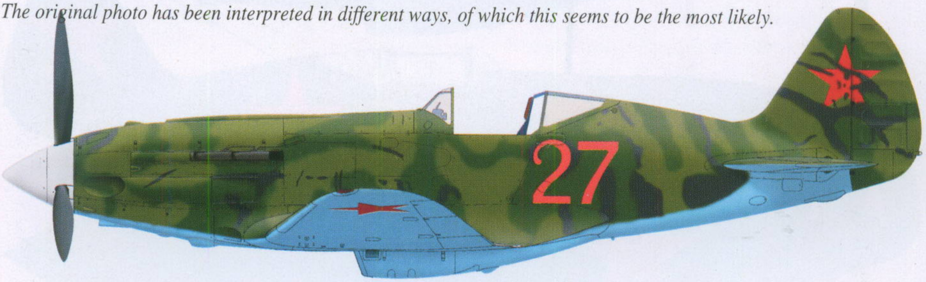


This plane "za rodinu" ("for the motherland") was flown during 1942 by V.V. Rybalko of 122 IAP, and was probably the same white plane with red arrow delivered to 172 IAP during a ceremony on February 1, 1942. Unlike "Za Partiy Bolshevikov", this plane no longer has the red arrow.

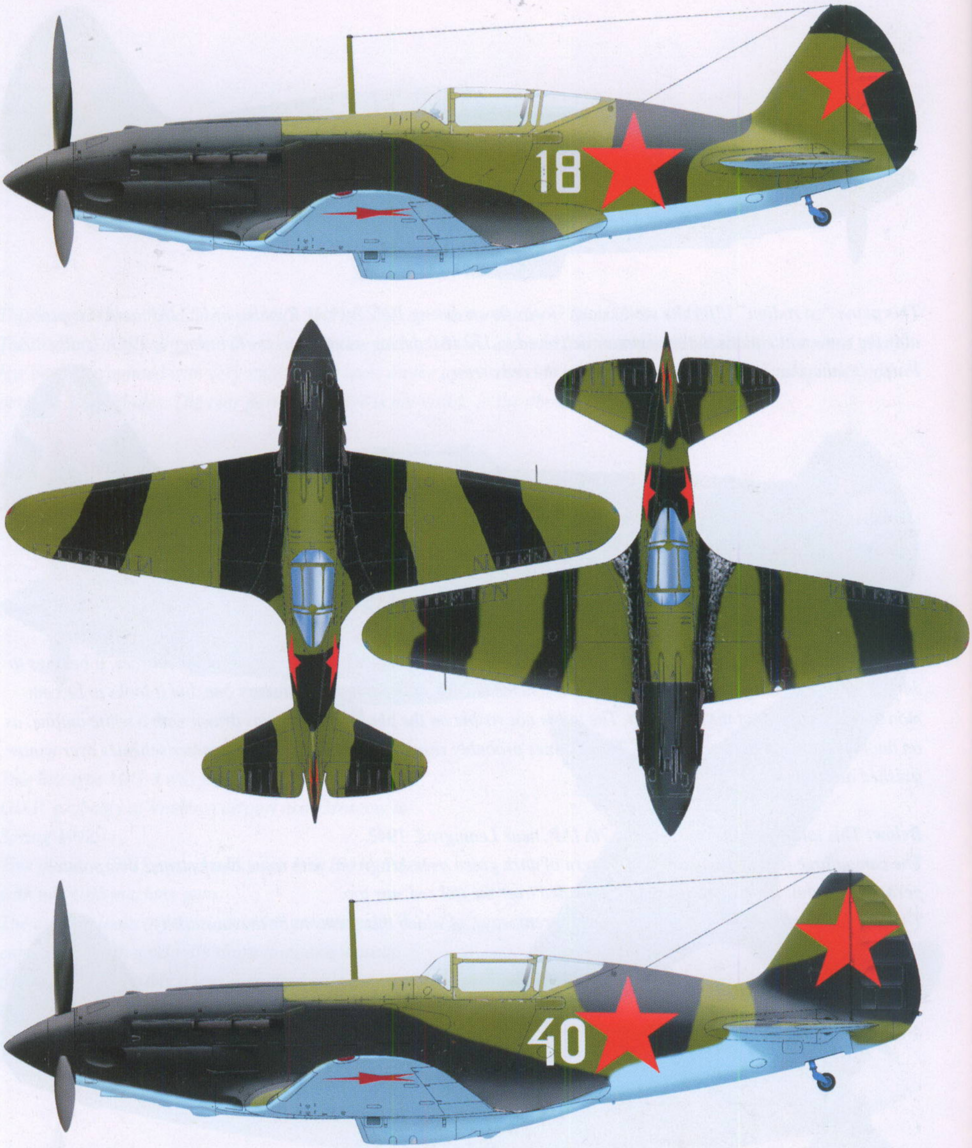


This late type MiG-3 is of 7th IAP VVS ChF (Black Sea Fleet) during 1943 (according to other sources, it belongs to 34 IAP, Moscow zone, 1942). Its striking paint scheme is very different than the factory one, but it looks to be common to other aircraft of the same unit. The tail is not visible on the photo; the star was drawn with a white outline, as on another plane on the background. The schemes probably result from repainting new summer schemes over winter finished aircraft.

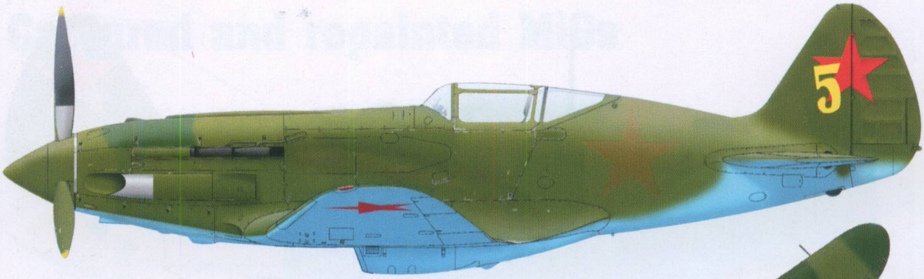
Below: *This late type MiG-3 was of the 7th IAP, near Leningrad, 1942.*
The camouflage looks a non-standard pattern of dark green over AII green, with some black stripes overpainted, perhaps by hand; the black stripes look extended over the tail red star too.
The original photo has been interpreted in different ways, of which this seems to be the most likely.

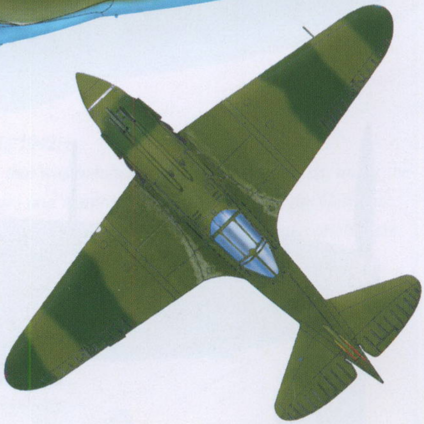


Opposite page: *This late type MiG-3 was the same white aircraft delivered during a ceremony to 172 IAP, and quickly passed to 122 IAP; the pilot was Nikolai Sheyenko. The unit used MiG-3s to escort bombers until 1943.*
The aircraft appears to have been roughly repainted in various colours: perhaps two shades of dark green, or dark green and black; on the tail, two bands of light colour appear to have been painted by hand.
The slogan " Za Partii Bolshevikov" ("For the Bolshevik Party") is still painted on both sides, as is the large dark red arrow, and, probably, the red tip of the spinner. The canopy struts and the edges of wings and tail show still traces of underlying white paint.



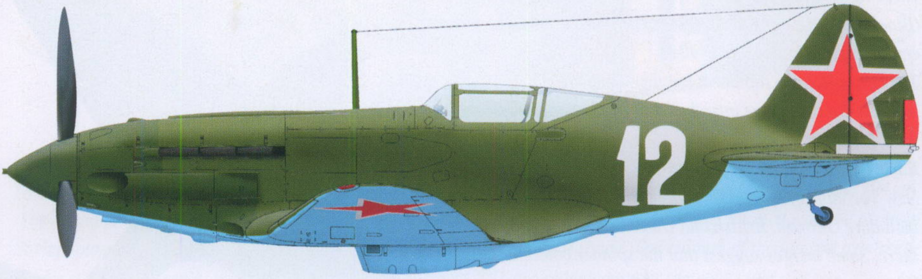
These planes with unusual camouflage schemes are shown in a wartime movie; they could belong to Leningrad PVO in 1942.
The schemes appear very different from the usual factory ones, but show similarity with other planes of the same unit; they look symmetrical.

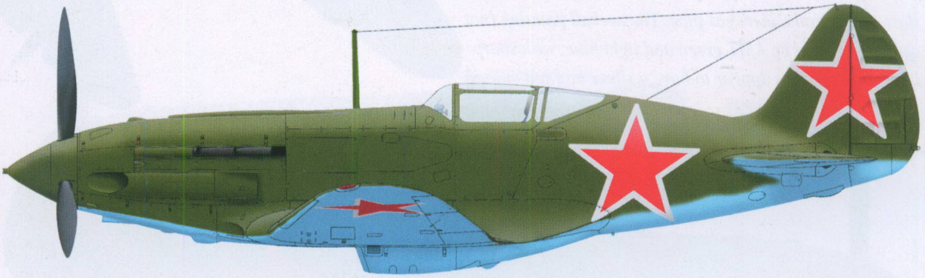




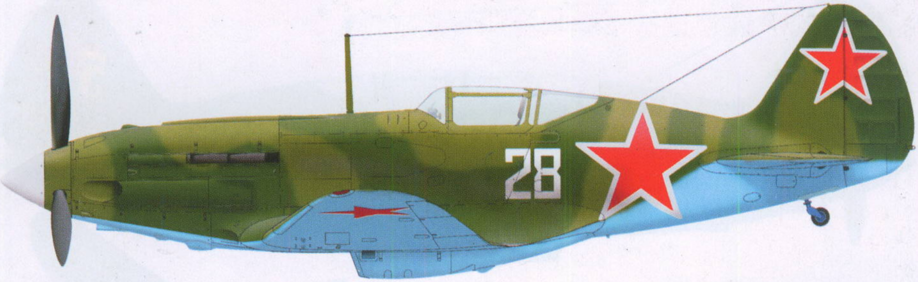
***Above**: Late type MiG-3 of unknown unit that made a forced landing in German hands. The aircraft appears to have been partially repainted green, or repaired with pieces of other planes.*

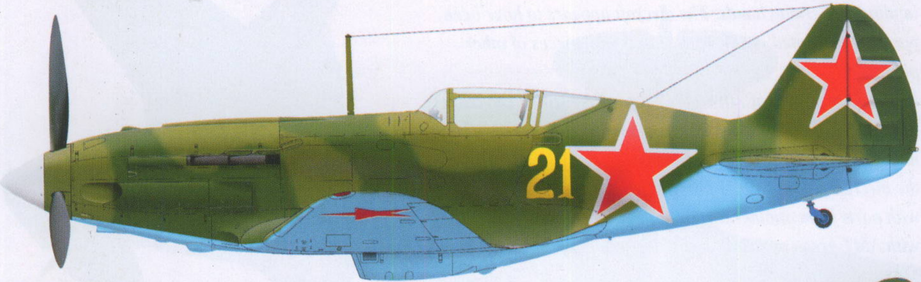
***Below**: Late MiG-3 of 7th IAD (Fighter Aviation Division) of the Pacific fleet air forces. Although a late type MiG-3, its exhaust stack configuration is like an early MiG-3 on both the aircraft shown; this is probably the result of field repairs with parts from another aircraft. It was repainted probably with AMT green and AMT light blue; the nose looks a slightly darker shade.*



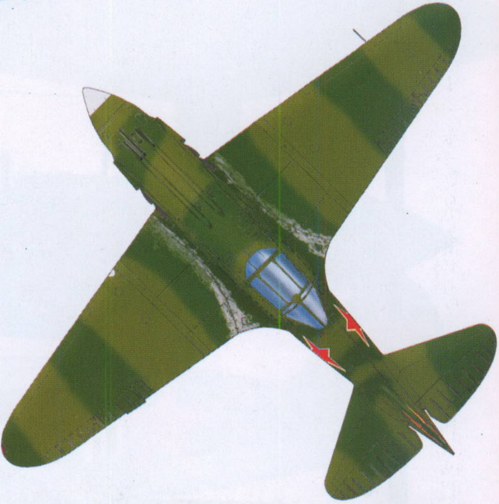


This profile represents an example photographed during the Spring 1945 at the Volsk Military Aviation School. It was probably repainted with AMT paints; the main undercarriage internal surfaces appear painted dark grey instead of light blue. The aircraft was intended for static purposes, to train the ground crew.

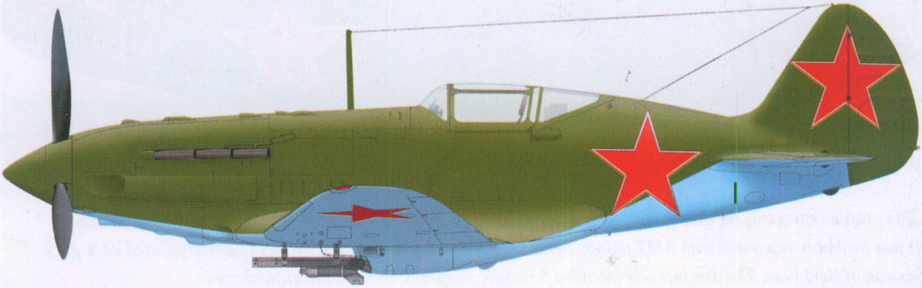




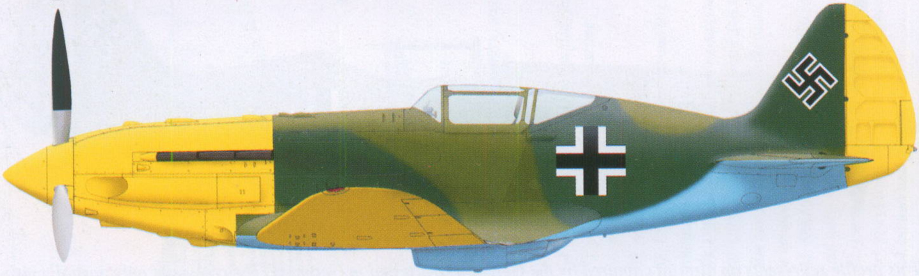
These late type MiG-3s were of 7 IAP VVS ChF (Black Sea Fleet) in Kuban, 1943. The unit employed them alongside P-40s. The camouflage is standard, but the white outlines on the stars were introduced in 1943.



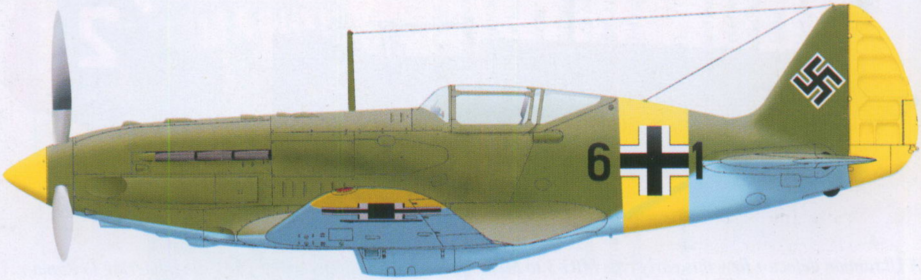
Early type MiG-3 displayed mid-1943 at the Bureau of New Technology of TsAGI. Many contemporary planes, including German, British and US ones, were displayed there. Some images suggest that the spinner could have been repainted red at some time whilst at the Bureau. Although it is an early type MiG-3, it is equipped with slats, rocket rails, inert gas pipe. The overall painting (not original) should be AMT green and light blue, with sharp lines; the red stars appear to have a silver and red outline.



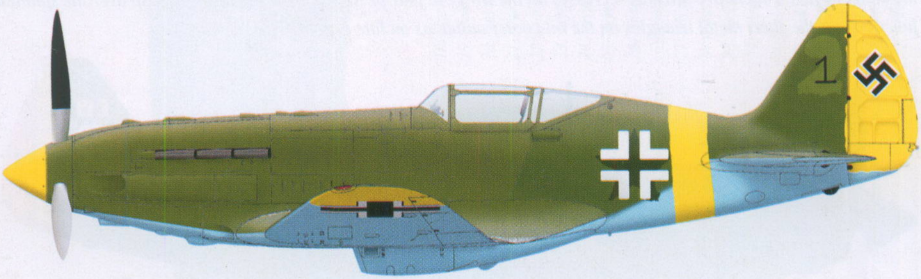
Captured and repainted MiGs



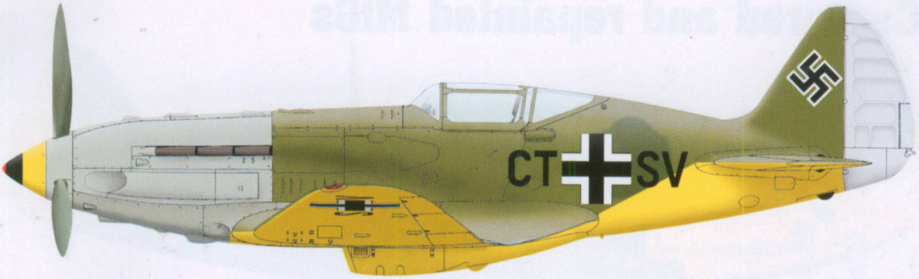
MiG-1 captured by the Germans and displayed in Berlin during 1942.
There was a propaganda exhibition called "Russenparadies", that was bombed by German communists, under the leadership of Bruno Baum. The rear fuselage, tail, fuselage sides and wingroots were repainted by the Germans, probably with Dunkelgrun 71, to delete Soviet markings and cover worn surfaces. The external wing panels were repainted yellow, without black crosses. The plane was probably never flown with this livery.



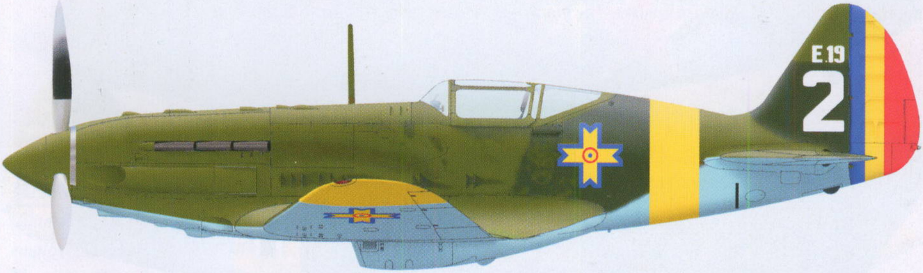
This early MiG-3 was captured by the Germans and tested probably at Rechlin air base, in Germany in late 1941. The example is one of 22 captured in near flyable condition in the first days of war. It was painted with the original Soviet colours; note that the fuselage band has slightly oblique forward shape. The colours of the tail are hypothetical, as it can't be seen in the photo. Probably the numbers 6+1 are repeated under the wings too.



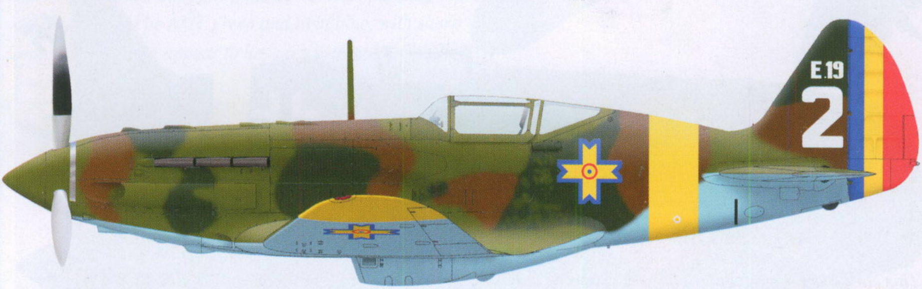
This early MiG-3 was captured by the Germans and tested, perhaps at Rechlin air base, in Germany in late 1941. The aircraft is overpainted with crude yellow identification bands and German national markings; note that the fuselage band was crudely and obliquely hand-painted. The original red star on the fuselage (and probably on wing uppersurfaces) is still visible, probably repainted with dark green 71.



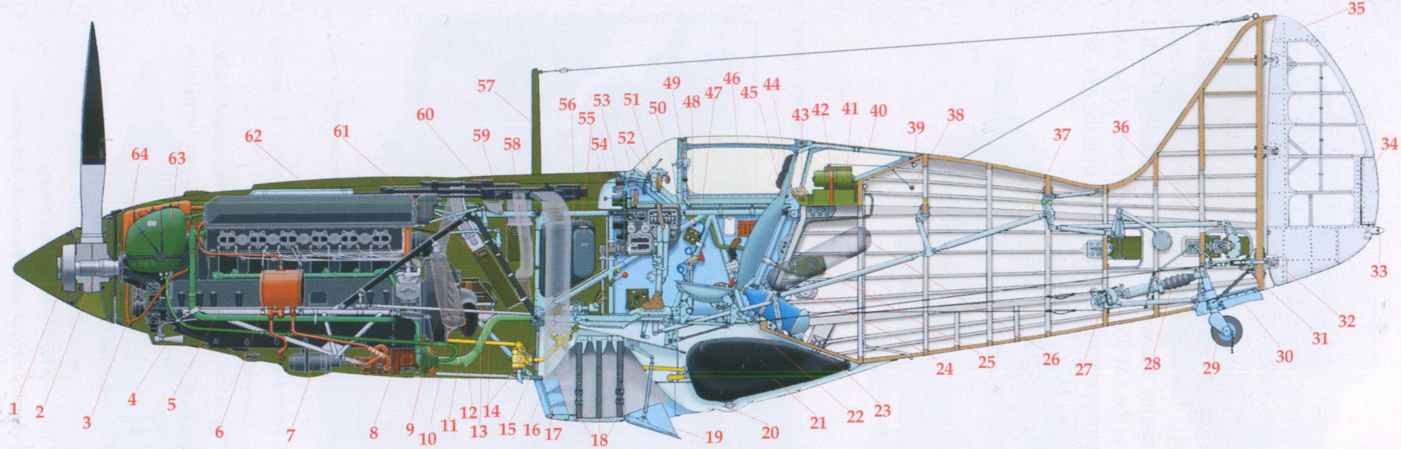
This profile represents an aircraft captured by the Germans and tested in Germany. The codes are only partially visible; they could be CT+SV. The whole undersurface could have been repainted yellow, as shown here.



A Ukrainian defector flew this early type MiG-3 to Melitopol airfield on 3 December 1941, surrendering to Rumanian troops. The aircraft was repainted in Rumanian markings and flown at Brasov by ARR's top ace Cpt 'Bazu' Cantacuzino, and used as an "aggressor" for evaluation and training purposes. The white E.19 on the vertical stabilizer referred to Escadrila 19 observatie (19th Reconnaissance Squadron) based at Melitopol during 1941. The Soviet green surfaces were partially repainted with Rumanian green; some cooling slots were added on the mid fuselage sides. The wingtip were yellow for recognition and to cover the wing stars, both on the uppersurfaces and on the undersurfaces; there are Michael's crosses on the wings in four positions. Note the metallic strip over the spinner junction and the sheet metal triangles on the oil cooler outlet, as on late type MiG-3s.



At a later date, some camouflage mottle was added. Soviet troops seized this aircraft from the Rumanians in September 1944, after Rumania broke its alliance with Germany and established a new one with the Soviet Union.



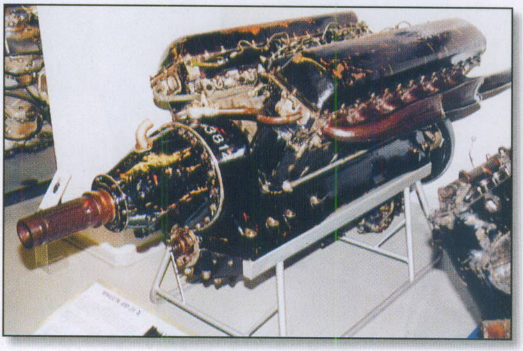
1. AV-5L-123 propeller hub
2. propeller shaft
3. reduction gear of Mikulin AM-35A engine
4. venturi
5. engine support structure
6. oil cooler (both sides)
7. dynamo GS-350
8. oil and coolant pump
9. supercharger
10. ShKAS cartridge links bag (one on left side for both ShKAS; drawn as transparent)
11. supercharger inlet from wingroot intakes
12. cooling circuit (green)
13. battery (right side only)
14. actuating shafts for oil cooler outlet shutters
15. fuel circuit (yellow)
16. UBS cartridge ejection duct (to a slot on the left of the glycol cooler)
17. air intake deflector of glycol cooler (2 vertical + 2 horizontal blades)
18. glycol cooler
19. cooler outlet flap with actuation mechanism
20. fuel tank drain cap
21. rear fuel tank
22. seat support structure
23. oxygen bottle (right side)
24. oxygen bottle refuelling hatch (right side)
25. socket for battery recharging on the ground (right side)
26. compressed air bottle (left side; drawn as transparent)
27. tail wheel retraction mechanism, operated by wires
28. shock absorber
29. retractable tail wheel
30. tail wheel door
31. rudder actuating mechanism
32. rudder hinge
33. tail position light (white)
34. trim tab
35. rudder, underlying metal structure
36. elevator shaft
37. elevator actuating rods
38. side hole for wire aerial
39. ventilation hole
40. rear guide for sliding hood
41. RUN-30A dynamotor for RSI-3 (on left side)
42. RSI-3 radio transmitter (rarely installed); it hides the RU-11A dynamotor (on right side) for RSI-4 radio receiver (installed on the floor)
43. tool pack
44. connection bolt between mid fuselage frame and rear wooden fuselage
45. seat armoured backrest
46. sliding hood
47. side guides for sliding hood
48. radio control panel
49. sliding hood locking mechanism
50. three-piece windshield and joint line between its transparent panels (no frame)
51. PBP-1A gunsight
52. arming handles for UBS (centre) and ShKAS (both sides)
53. instrument panel
54. upper (curved) and lower (angled) firewalls
55. priming fuel tank for cold starting
56. front fuel tank
57. radio aerial mast
58. UBS cartridge ejection duct and bag (drawn as transparent)
59. UBS ammunition box (360 rounds) and rail
60. UBS 12.7 mm gun (centre) and ShKAS 7.62 mm gun (right ShKAS in the background; left one is omitted)
61. ShKAS ammunition boxes (2 x 350 rounds) and rails
62. thermal sleeves for gun barrels
63. glycol (coolant) tank and pipes (green)
64. oil tank and pipes (brown)

Mikulin AM-35A Engine

The AM-35 was a development of the Mikulin M-34, used in DB-3 and R-Z planes in the '30s. About 50 were built in 1939/40. The AM-35A was a developed version with improved supercharging. This large engine was specifically intended for high altitude use by the chief designer Mikulin; it equipped both the single engined MiG-1 & MiG-3 fighters and the four engined Petlyakov Pe-8 bomber; it was also used on some Yermolaev Yer-2 long range bombers,which were later fitted with diesel engines. The AM-35A was built in Zavod 24 from the end of 1940 to late autumn1941; then production was moved to Kuybishev, in the Urals, when the Germans approached Moscow. This engine was very similar to the AM-38 of the Il-2 Shturmovik, built in the same plant. The mass production of the AM-35A was stopped in favour of the AM-38F at the end of 1941. After that, some small batches were still built, often utilizing parts from the AM-38F. About 4500 AM-35As were built between late 1940 and late 1943.

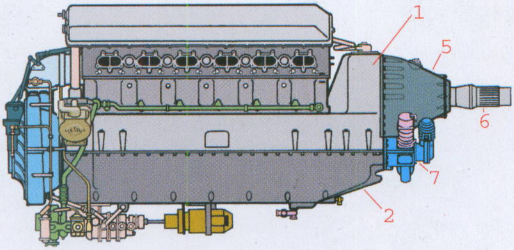
Technical data for the AM-35A:
12 cylinder 60^0 vee engine
max power : 1350 hp (993 kW)
volume: 46.66 litres
compression ratio: 7.0:1
reduction gear ratio: 0.902 (until summer 1941), then 0.732
fuel consumption: 330-360 g/hp per hour
nominal rate: 2050 rpm
maximum rate: 2350 rpm
length: 2402 mm,
width: 866 mm,
height: 1089 mm;
weight: 830 kg.

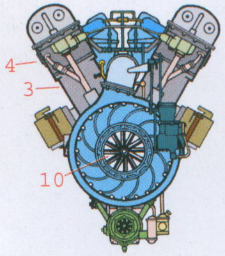
Thomas Siepert

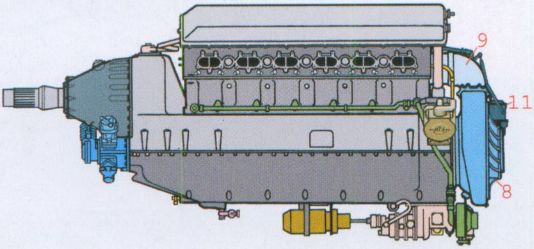


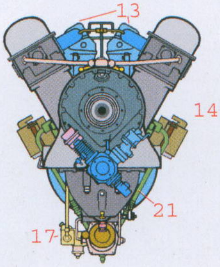
Opposite page: *Detail drawings of the AM-35A engine. On the left side view, the left cylinder bank is omitted.*
Note that the colours are purely for illustration. The real engine was painted gloss black with some unpainted details. Cooler ducts were light green, oil ducts were orange, spark plug wires were white.

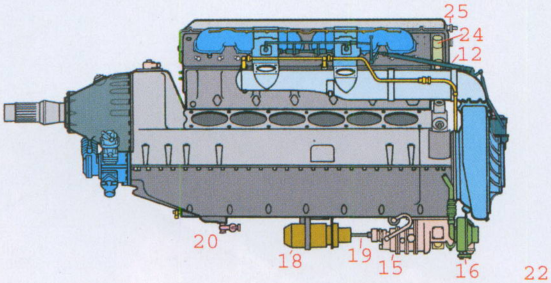
Legend:
1. engine main block (upper half, light grey)
2. oil sump (medium grey)
3. cylinder banks with 6 cylinders each (medium grey)
4. cylinder heads (dark grey)
5. reduction gear cover (greenish grey)
6. prop shaft (light grey)
7. auxiliary drive shaft (inside blue cover)
8. supercharger (azure)
9. manifold (pale azure)
10. supercharger impeller through the opening for inlet duct (black/white)
11. Supercharger, manifold and carburettor air flow controls (blue-green)
12. levers connected to the carburetors and manifold shutter
13. four carburetors (azure) and ducts to cylinders (medium blue)
14. magnetos (on both sides, khaki) and supports to (1)
15. oil pump (under the engine, flesh)
16. cooler pump (under the engine, light green)
17. fuel pump (beside the oil pump, cream)
18. electric generator (under the engine, dark yellow)







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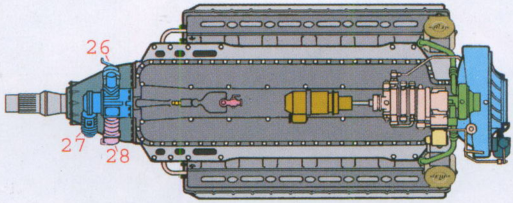
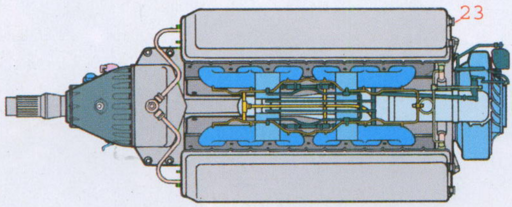




19. small shaft for (18)

20. venturi (pink)

21. cooler pipes (green)

22. oil pipes (orange)

23. Y-shaped pipes for oil and supply to the camshafts

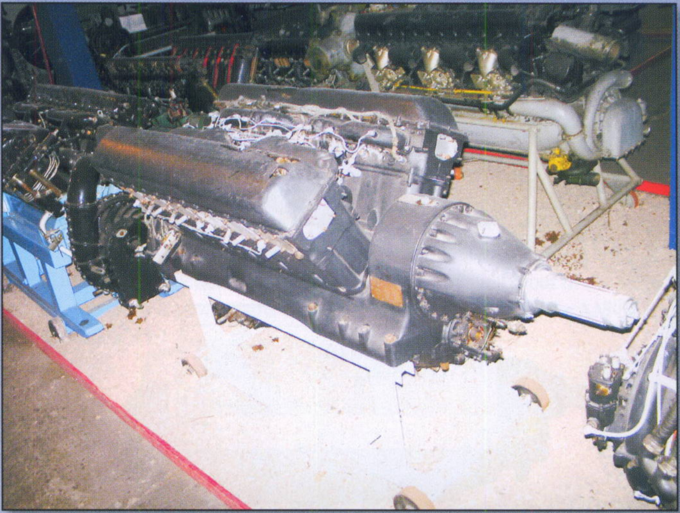
24. pressure distributor for engine starting (light green, behind the cylinder banks) it's a rotating valve that sends compressed air to the cylinders to start the engine.

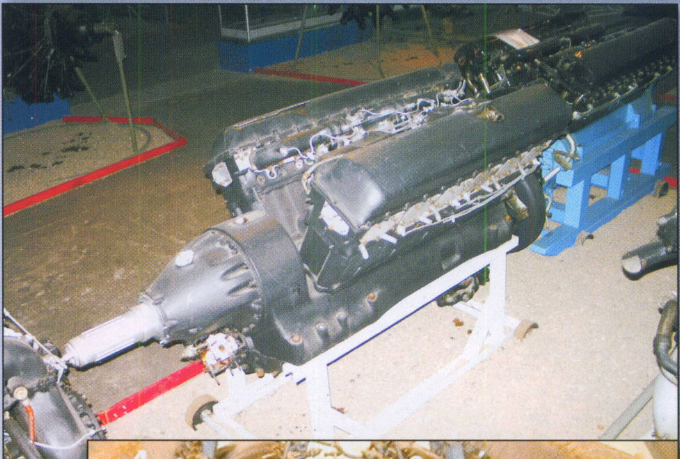
25. unknown

26. air compressor (right forward part, blue)

27. vacuum pump (right rear part, pink)

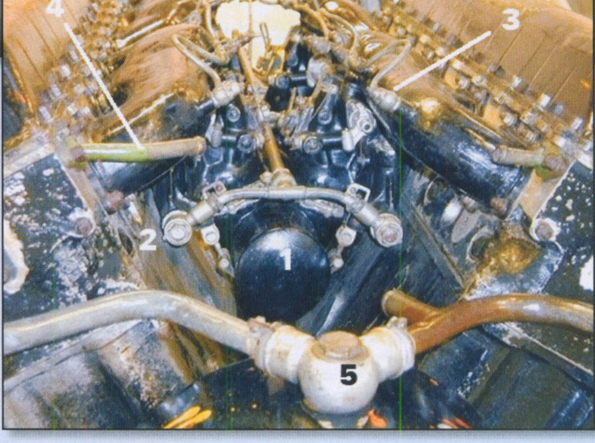
28. propeller governor (left part, light blue)





The AM-35A preserved in the Krakow Museum. All the holes for exhausts and for oil and coolant pipes are closed by thin aluminium plates, and the pipes themselves are missing.

Jan Hoffmann



In this front view of the AM-35A preserved in Finland we can see:

1.the head of the main manifold;

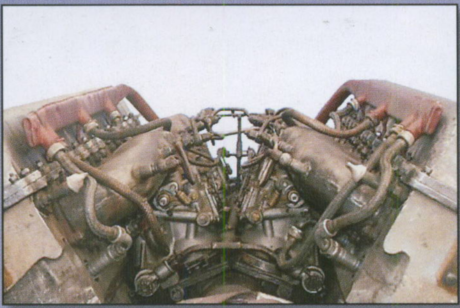
2.the other end of the fuel pipes to the carburetors;

3.the priming injectors for cold start;

4.two green pipes for coolant:

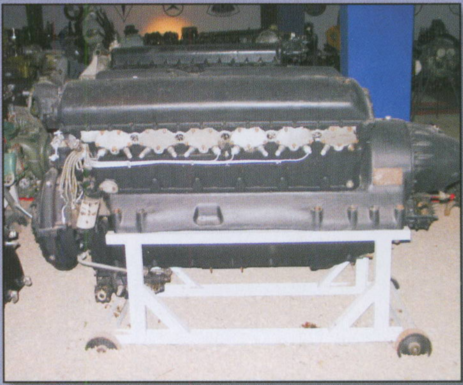
5.the horn-shaped oil ducts from cylinder banks to reduction gear.

Photo: Finnish National Aviation Museum via Kai Mecklin

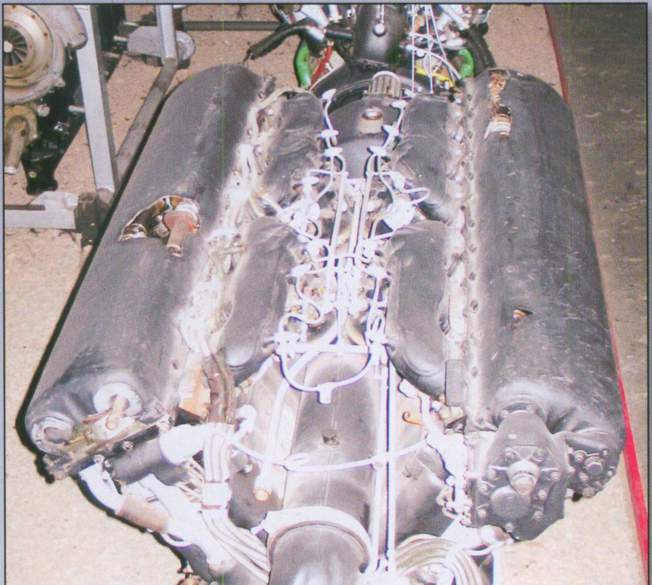


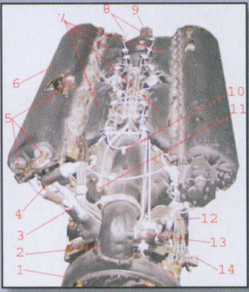
Another front view, but this is a restored AM-38F. Here we see that the spark plug leads on the inner side of the cylinder banks pass over the inlet ducts, and are well insulated, in a flat metal pipe; on AM-35s the wires had a thick insulation, but no such pipe.

Boris Osetinski of Aviarestoration



Starboard side of the engine.





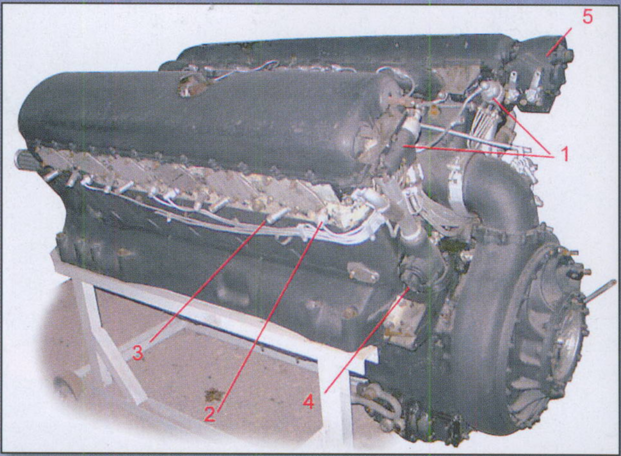
This shot from above-rear shows some other details:

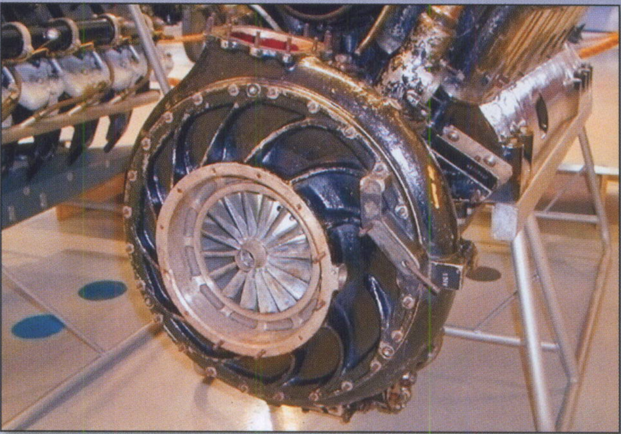
1.supercharger
2.main manifold
3.bifurcated oil pipe with a small shaft for distribution in it
4.pressure distributor for engine starting
5. distribution shaft
6.cylinder head cover
7. 4 manifolds (1 for each 3 cylinders)
8.injectors and pipes for cold start
9.prop shaft
10.pipes for cold start
11.fuel pipe to 4 carburetors
12.spark plug leads (disconnected)
13.air shutter control (external levers missing)
14.support for magnetos (missing)

Jan Hoffmann

1 - Compressed air distributor for engine starting.
2 - Compressed air valve for engine starting (one for each cylinder).
3 - Spark plugs (two for each cylinder, one on the inner side, one on the outer one).
4 - Magneto joint coupling (magnetos, one for each side, are missing)
5 - gun synchronizer (both sides).

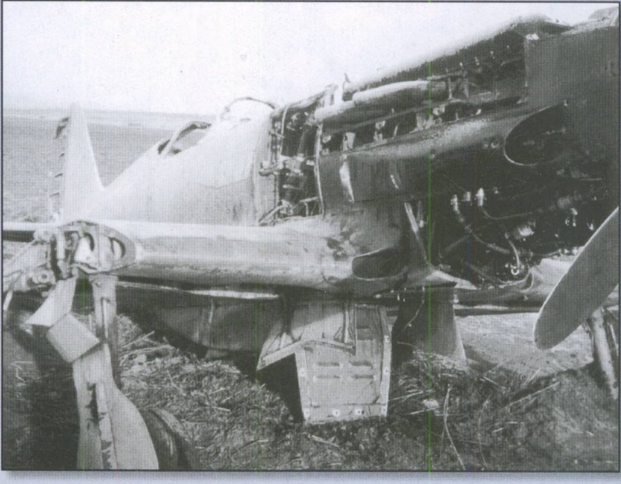
Jan Hoffmann





These images from behind show the centrifugal supercharger. The supercharger impeller is moved by the crankshaft via an epicyclic gearing and turns at much higher rpm.

Finnish National Aviation Museum via Kai Mecklin

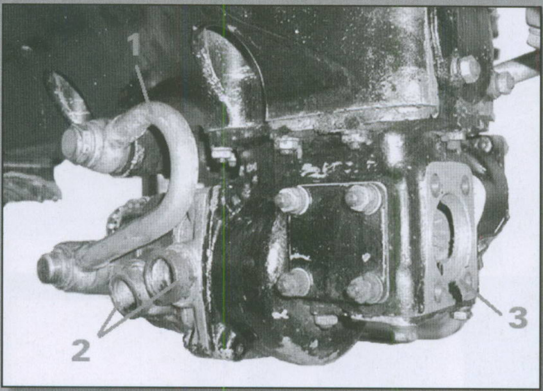


Right: Wartime photo of the engine.

Stratus coll

Opposite page bottom: Destroyed MiG-1 at Simferopol, Russia, showing engine mount.

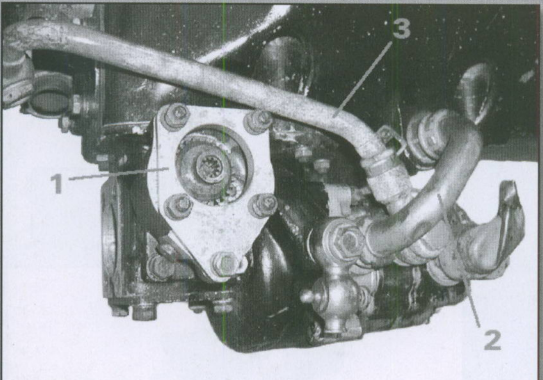
Stratus coll.



This image from the left side shows the lubrication pump under the engine block.
The drive reaches the pump by an internal vertical shaft.

1. *a short oil pipe collecting oil from the engine*
2. *two outlets for pipes directed to the side oil coolers*
3. *on the rear, the connection for a coolant pump (absent)*

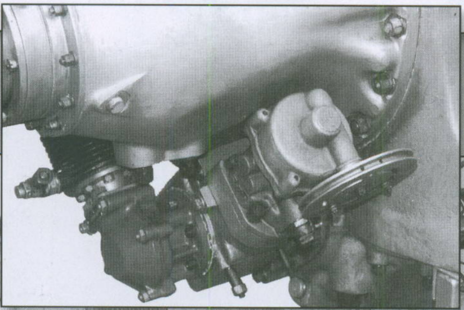
Photo: Finnish National Aviation Museum



The same device seen from the right side;

1. *the connection for the fuel pump (absent),*
2. *a short lubrication pipe from the engine block to the pump;*
3. *another pipe for oil*

Photo: Finnish National Aviation Museum via Kai Mecklin

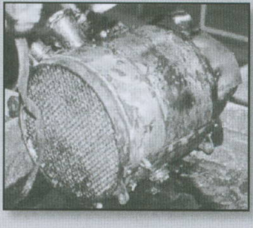


***Left, below**: This image shows details from an AM-38F under restoration by Aviarestoration. Air compressor (right forward part); vacuum pump (right rear part); propeller governor (left part)*

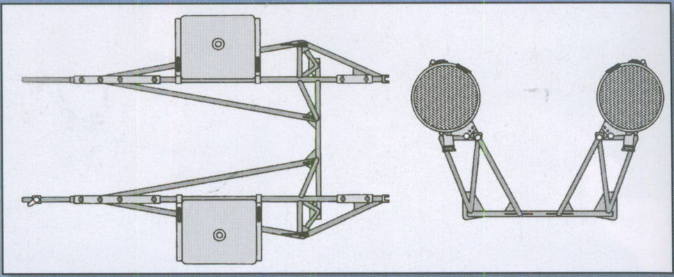
Boris Osetinski of Aviarestoration

***Below**: This is an oil cooler, again from Aviarestoration. It has to be installed into the tunnels on the side of the nose. The pipes should point downwards when the cooler is installed.*

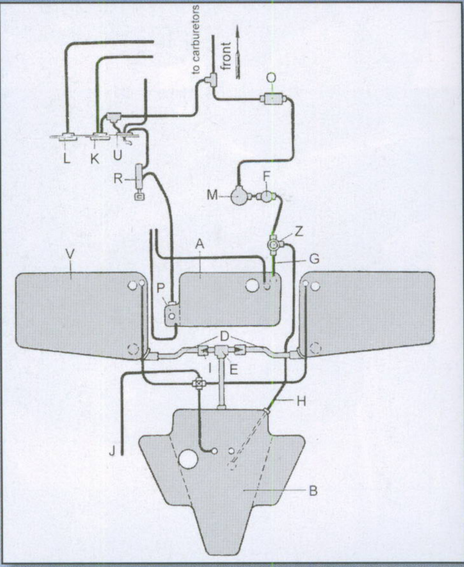
Boris Osetinski of Aviarestoration

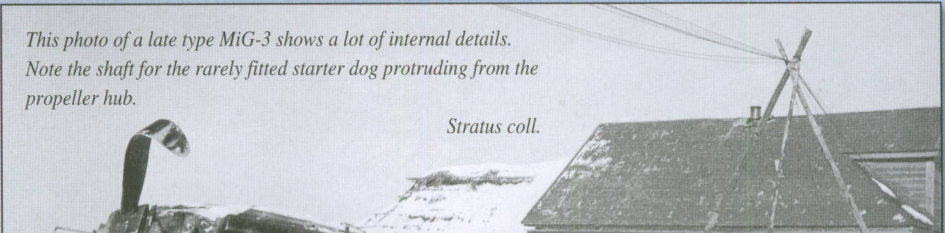


Top:
The engine supports and the oil coolers.



Middle:
This schematic diagram of the MiG-3 fuel system shows:
A-front fuselage fuel tank
B-rear fuselage tank
V-wing fuel tanks
P-priming canister for engine starting
R-manual pump for priming fuel
U-starter switch on throttle panel
M-fuel filter
Z- Switch from rear tank to front tank
G-fuel pipes from tanks
J-tanks venting line (probably to the holes behind the canopy)
I-one-way valves from wing tanks to the rear fuselage tank
D-pipes connecting tanks to transfer fuel from wing tanks to rear fuselage tank
Zh- fuel pipe
O-fuel pump, aside the oil pump under the engine
L, K – instruments on panel
F-fuel cut off (?)



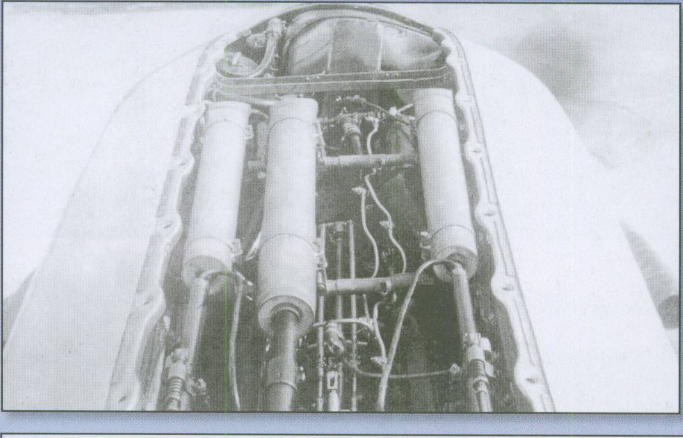


This photo of a late type MiG-3 shows a lot of internal details. Note the shaft for the rarely fitted starter dog protruding from the propeller hub.

Stratus coll.

Armament

Most MiG-3s were armed with three syncronized guns over the nose:
- one UBS 12.7 mm machine gun in the central position,
- two smaller ShKAS 7.62 mm machine guns at the sides.



This image shows some details of I-200, probably no.02 or 03, and is representative of early MiG-3s too.

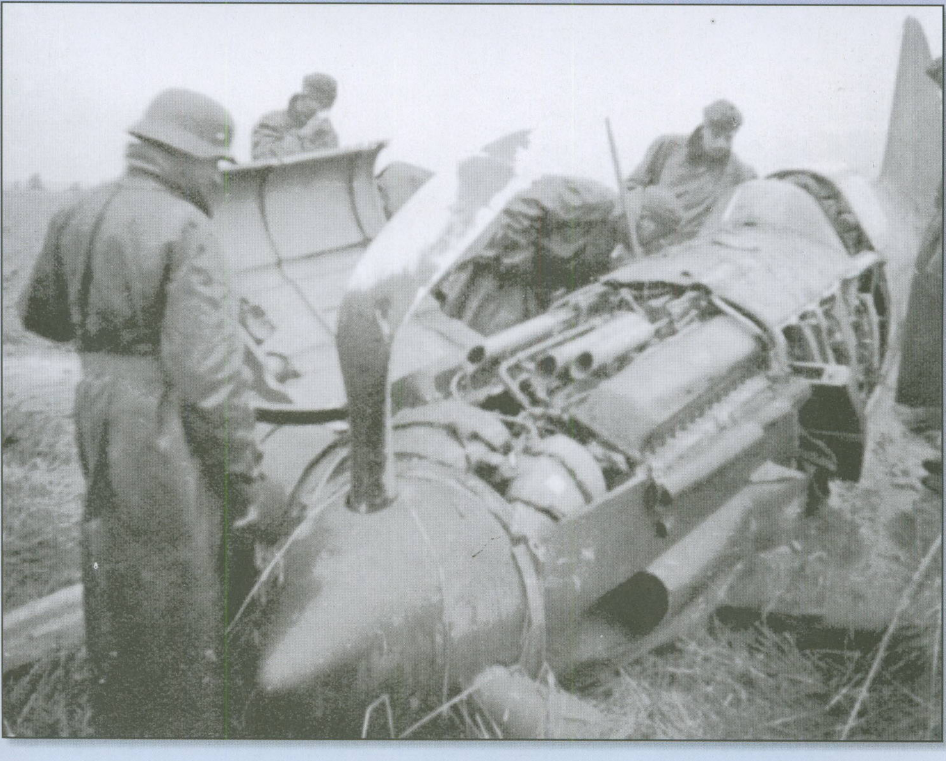
Late type MiG-3s had a large panel over the engine.

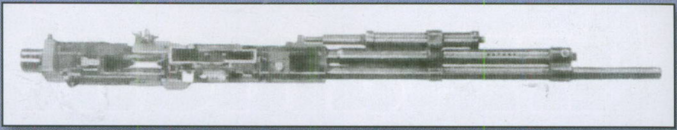
There is one UBS machine gun in the central/left position, and two ShKAS at the sides.

The image shows the gun barrels, enclosed within thermal sleeves to avoid icing.

Thin pipes connected to the ShKAS, are probably for pneumatic reloading.

The sleeves are supported by two transverse tubes above the engine.

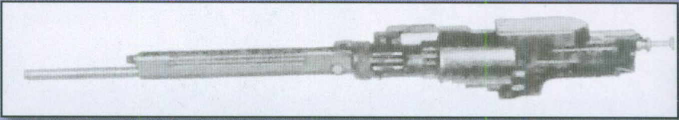




UBS 12.7

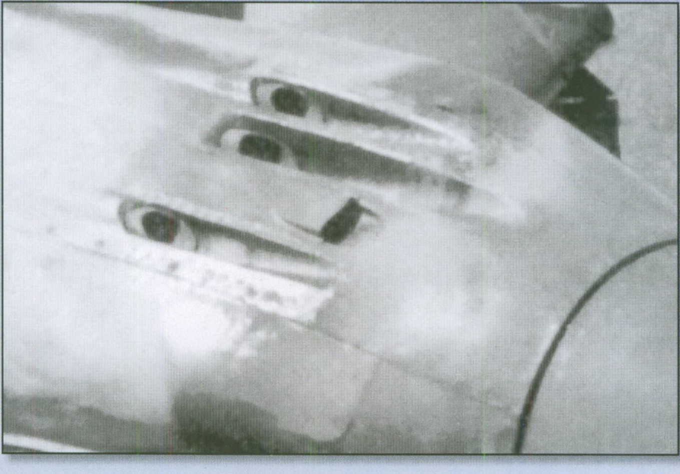
The Universal'ny Berezina Synkhronny (Universal Berezin Syncronized) was developed from 1940 into four versions:

UB - multipurpose by Berezin, Universal'ny Berezina;
UBS - synchronized, Synkhronny;
UBK - wing mounted, Kryl'evoj;
UBT - or turret, Turel'nij;
The UBS fired the 12.7x108 mm round at a rate of 1000 rpm, at a muzzle speed of 860 m/s; it weighed 21.5 kg

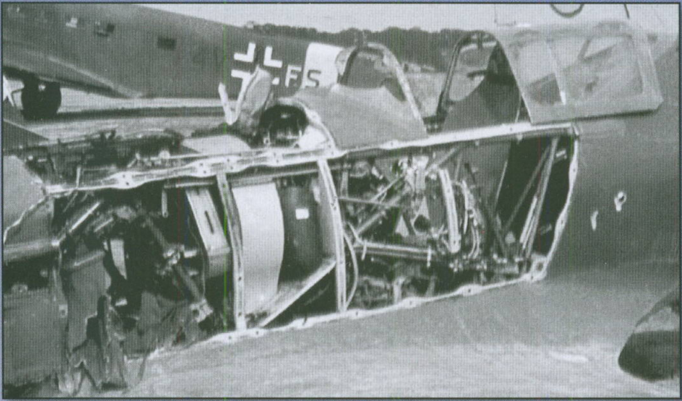


ShKAS 7.62

The ShKAS, Shpitalny-Komaritski Aviatsionny Skorostrelnij (Shpitalny-Komaritski rapid fire machine gun for aircraft) was the standard 7.62 mm gun from 1935. It fired the 7.62x54mm round at a rate of 1800 rpm, at a muzzle speed of 825 m/s; the weapon weight 10 kg, and was produced both for fixed fighter installation and with a handle for defensive installation.

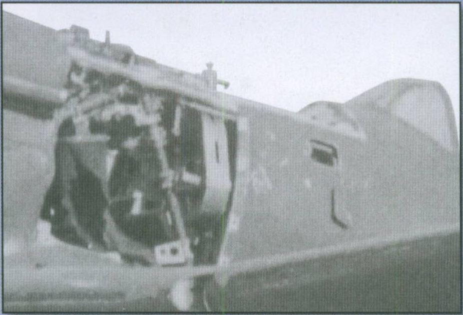


The gun firing slots on the nose of a three-gun-armed MiG-3. Note the angled ends of the protruding blast tubes.



Details of the machine guns installed in the fuselage.

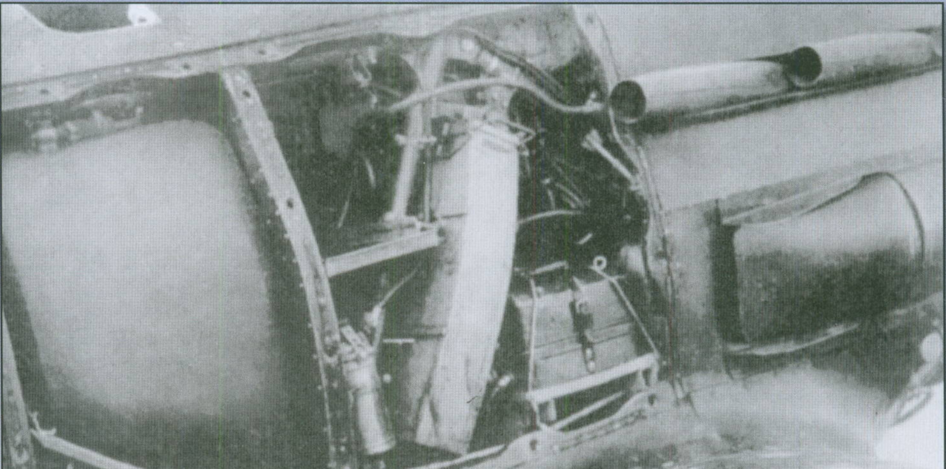
Jan Koennig



The image on the left shows better how the waste links bag was fixed in place. Noteworthy is the open hatch for priming tank access; the open hatch cover is attached by a wire.

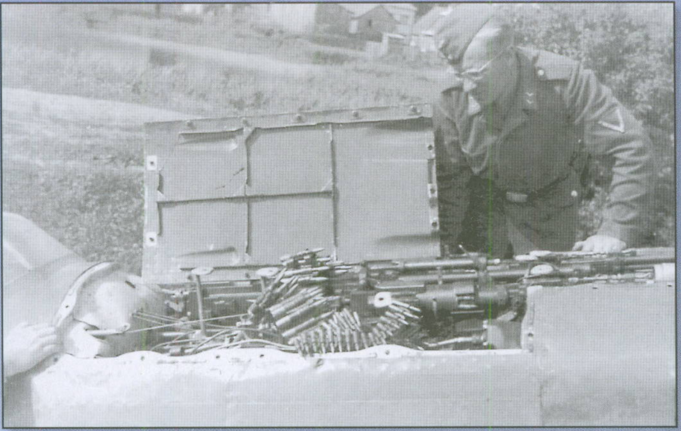
Denes Bernard

***Bottom:** The removed panels on the side of this I-200 let us see the angled ammunition box for the right ShKAS. The boxes for the ShKAS were side by side, and probably both were accessible from the right side only. The ammunition box for the UBS should be on the console on the back of the other boxes, but it is missing here The photo shows also the battery and the fuel tank.*



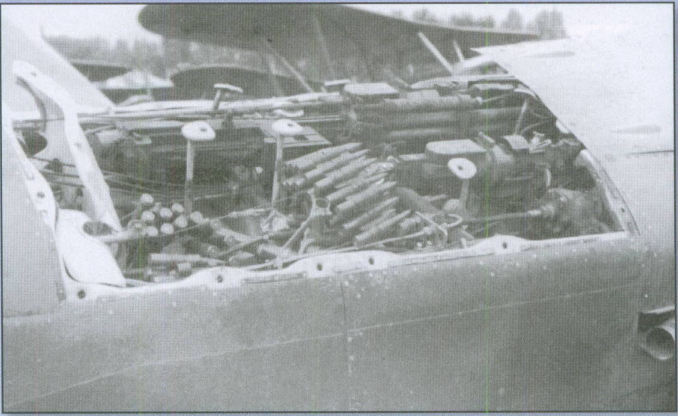
Top: *The panel held by the German soldier is from an early MiG-3; it goes over the engine, not on the gun bay as can be seen from the photo above.*
The same image shows:
the curved firewall separating the cockpit from the gun bay;
the wall is crossed by the gun firing and arming wires;
the flanges to which the removable panels were attached;
ammunition belts for UBS and ShKAS.

via Tomasz Kopański



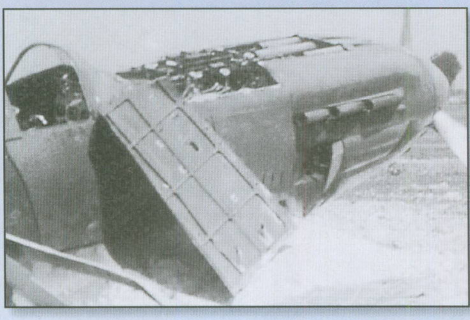
Middle: *Another image of ShKAS and UBS with their ammunition belts.*

Denes Bernard



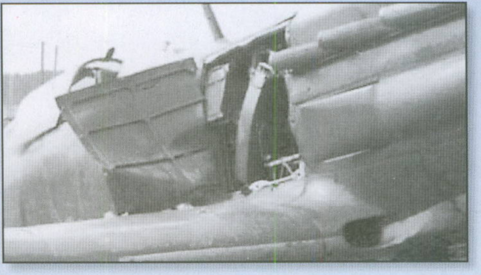
Below: *The internal face of the upper nose panel. The hole for the antenna mast is noteworthy. When installed, the panel was locked by Dzus fasteners both on its sides and on some internal supports.*

Jan Koennig



Below: *The inner face details of a side panel. The colour looks slightly darker than the external face; it could be the same green of the exterior (but not faded by sunlight).*

Jan Koennig

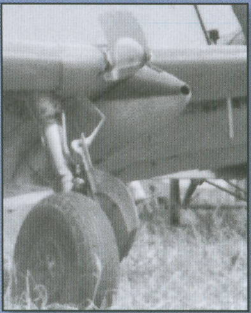


Underwing gun pods

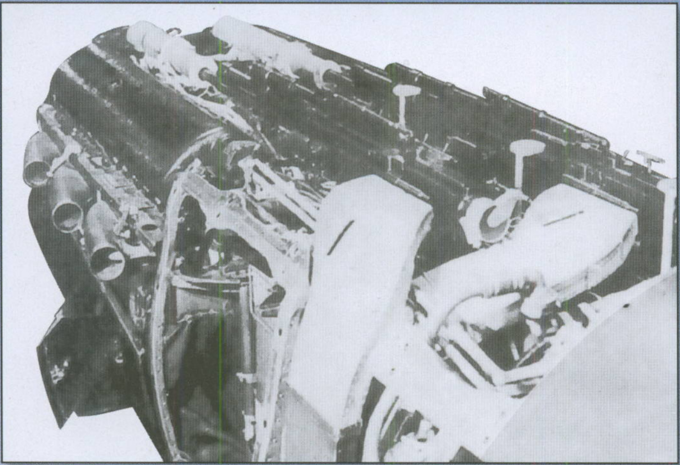
From February 20, 1941, MiG-3s were produced with two further 12.7 mm UBK guns on under-wing pods with 145 rounds each.

This proved unsatisfactory, as the weight increased of about 150 kg, affecting the flight characteristics by the aircraft; besides, firing under the high g manoeuvres was inaccurate due to torsion flexing of the wings, so the most of the gun pods were removed when the aircraft arrived at the units.

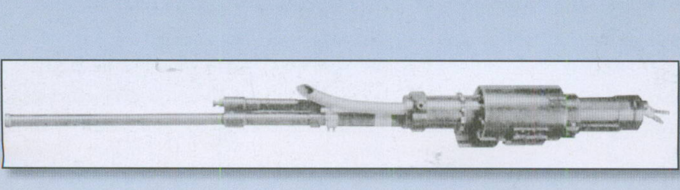
821 MiG-3s with 5 guns were produced through July 27, 1941, when the under-wing guns were deleted from production, and the armament returned to the original standard. *(See scale plan on page 27)*



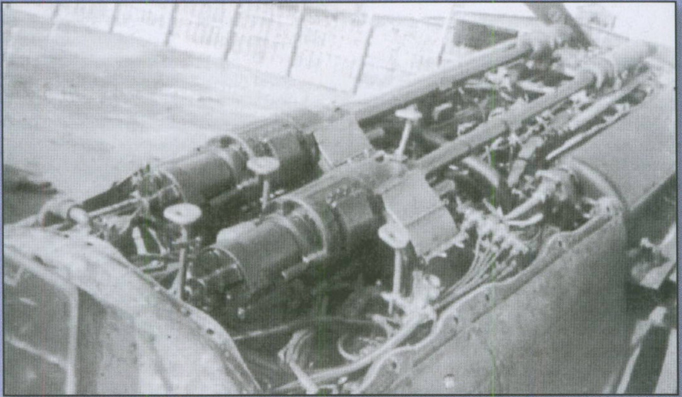
***Above**: The underwing pod, without the gun barrel protruding from it. We see the opened ammunition door too, and a distorted landing light panel. The aircraft is an early one, without slats.*
Note that the pods are painted separately from the wing.
Jan Konning



***Above**: 315 late production MiG-3s were armed with 2 UBS with 700 rounds each, instead of the usual armament. No images of the twin UBS ammunition boxes are available, but it's likely that they were in tandem, which is why the right UBS was shifted back relative to the left one; the different lengths of the blast tubes are noteworthy.*
Both UBS receive their rounds from the right side, and expel spent cartridges and links on the left. The dark bag for waste shell links is partly visible. It is not clear if MiG-3s armed with two UBS were externally distinguishable from ones armed with three weapons; probably they weren't.
Image from Istrebitel MiG-3 by Medvedv, Kazanov, Maslov, ed. Rusavia

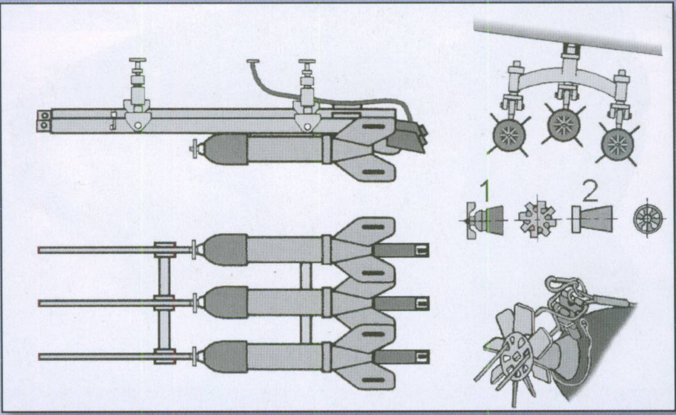


***Bottom**: About 50 late production MiG-3s were armed with a couple of ShVAK 20 mm guns. The ShVAK gun was designed and first built in 1936, and utilized an operating system similar to that of earlier ShKAS.*
Rate of fire: about 800 rpm-
Weight: 42 kg
Overall length: 1.76 m
Barrel length: 1.25 m



The installation of ShVAK guns looks very similar to that of two UBS; the right side gun is shifted aft, due to the tandem position of the ammunition boxes and gun breeches.

Image from Aerokosmicheskoe obozreniye



The MiG-3 was provided with two 3ROB-82 racks for the rocket projectiles RS-82.

The triple launcher was preferred to individual racks because its installation was quicker, but the drag was greater.

Rockets were intended both for air-to air and air-to-ground use.

For air-to-air use, the rockets were fitted with AGTD-A-RS-82 time-delay fuses (1); the delay time was set by the ground crew from 2 to 22 seconds.

Some successes were obtained against German bombers, until the Germans adopted effective evasive manoeuvers.

For air-to-ground use, the rockets were fitted with AM-s-RS-82 contact fuses (2).

The effective range of rockets was 800 m, but their accuracy was poor, and they were usually fired in a salvo or quick succession.

The rockets were fired by an electric switch on the right console.

About 215 MiG-3s (late type, armed with 2 UBS) were built with rocket armament; occasionally rocket launchers were observed on early type MiG-3s too.

Rocket launchers are often observed in photos of MiG-3s on the Moscow front in winter 1941 and early spring 1942; during the late spring, unit commanders were authorized to remove them to save weight and drag.

RS-82 (roketniy snaryad 82, -"rocket projectile, 82 mm diameter") was 325 mm long; its weight was 6.8 kg, of which 0.5 kg were explosive.

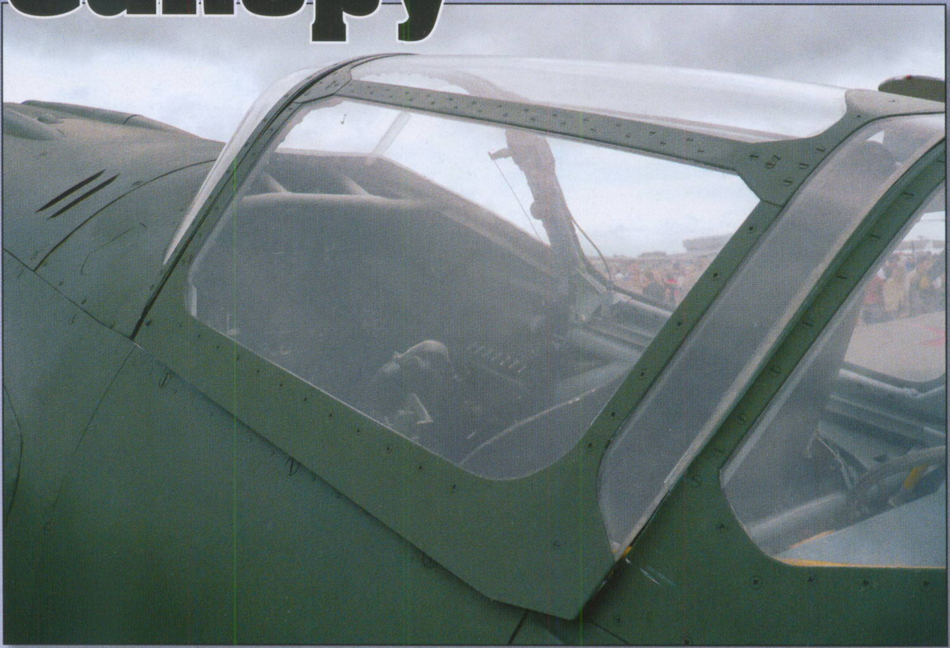
It was made of mild steel tubing, with four fins of steel sheet spot-welded on the body. Its flight speed was 350 m/s.

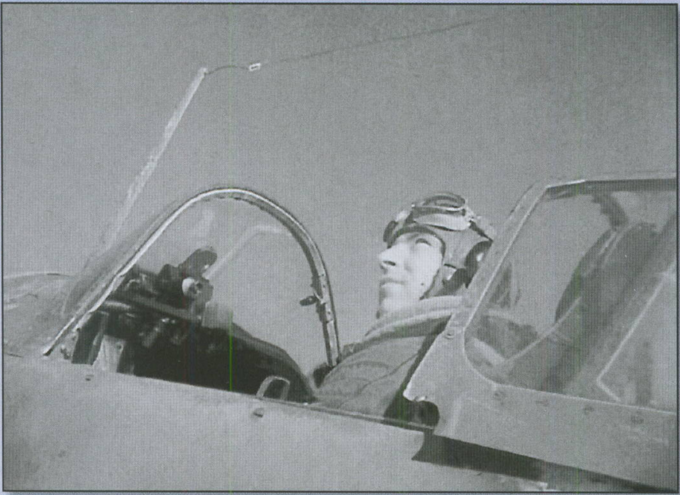
The fuse looked like an 8-bladed airscrew, and was usually fitted after the rocket was mounted on the plane. Prior to mounting of the fuse, the hole was closed by a reddish brown plastic cap.

The rocket was mounted on the rails from the front; two small mushroom-shaped pins were inserted in a longitudinal slot under each ROB-82 rail. Each rail had a black box with electric contacts for rocket firing at the back.

Bibliographic sources (including the memories of Pokryshkin) report the use of 100 kg and 50 kg free-fall bombs; some photos of early MiG-3 show the racks for these weapons, but no image of MiG-3s armed with bombs has been found.

Canopy





The canopy is made of three main parts: the windshield, the sliding hood and the rear part. Note that all the sliding guides are internal.

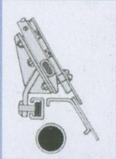
The lack of the PBP-1 A gunsight is evident in this rebuilt plane.

Yuri Pasholok

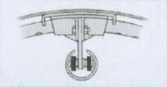
Above: *This historical image allows a comparison with the restored plane. We see the PBP-1 A gunsight installed; its colour looks dark (black?), different from other MiG-3s that had it painted a light shade; the cutout at the lower front of the canopy frame, common to planes of 148 IAP in winter 1941, but not observed in other units, is a field modification. Note the sealing line between panels of the windshield, often mistaken for a frame. Comparing the profile of the clear part of windshield with the one of the photo above, we see some differences.*

Here we see the light blue-grey shade of the inner face of the frames, and the front guides.. The MiG-3's sliding canopy had three guides:

left and right side guides, close to the tube structure

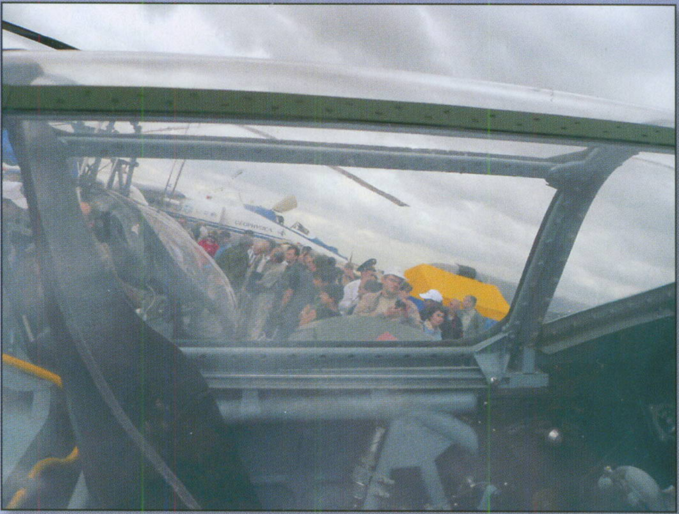


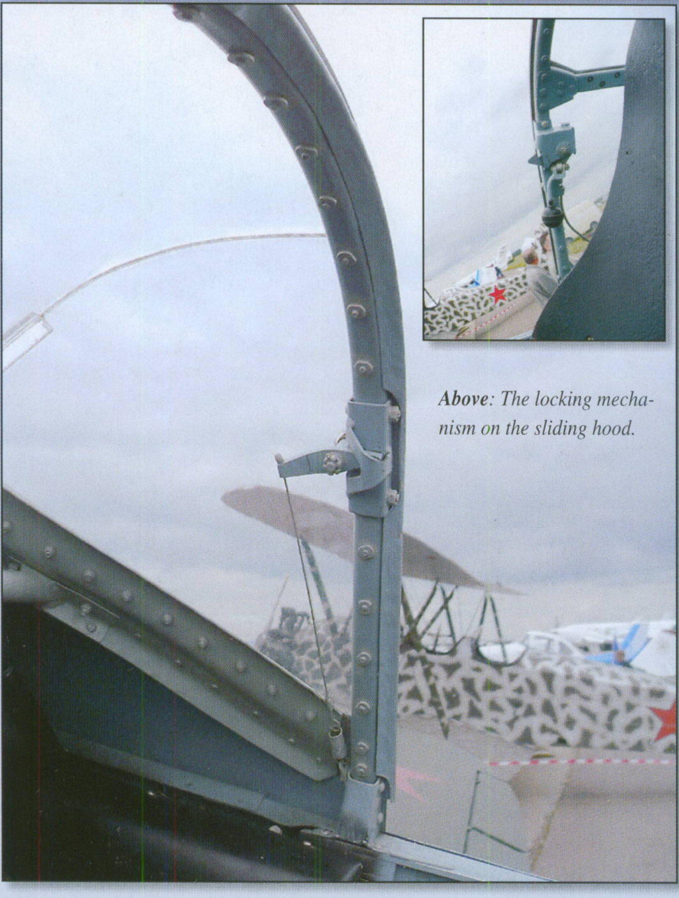
and centre rear guide, fixed under the central frame of the rear part of canopy.



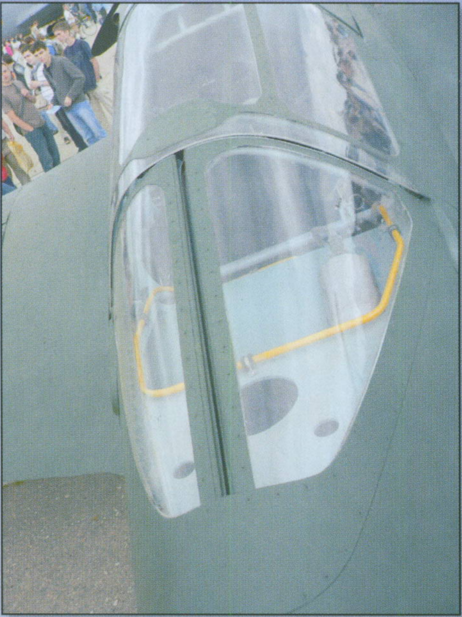
The frame itself was divided by a central slot that was visible from outside. The poor accessibility of this rear guide prevented the installation of a quick emergency release as on Spitfires, so most pilots flew with an open canopy.

***Right**: This image shows the **locking mechanism on the right side of the canopy. This was only on late type MiG-3s. Early MiG-3s had a handle on the centre of the sliding hood frame. The windshield itself was made of three** thermoformed pieces of plastic, probably glued to each other. The front part was nearly flat.*





***Above**: The locking mechanism on the sliding hood.*

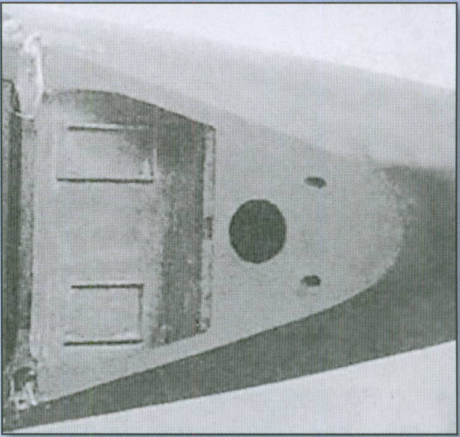


This image shows clearly the rear bay, where the radio equipment could be installed.

Wartime photos rarely show the protruding shape of the complete radio equipment (as illustrated on the drawings of Voronin) even when the radio mast was installed; this indicated that only few planes had the full radio equipment, while many others had only the receiver, or nothing at all. The slot in the mid of the upper frame is the third (rear) guide of the sliding canopy.

The yellow pipe passing around the radio bay is the vent line of the fuel tanks; it's not known if this was identical to wartime MiG-3s.

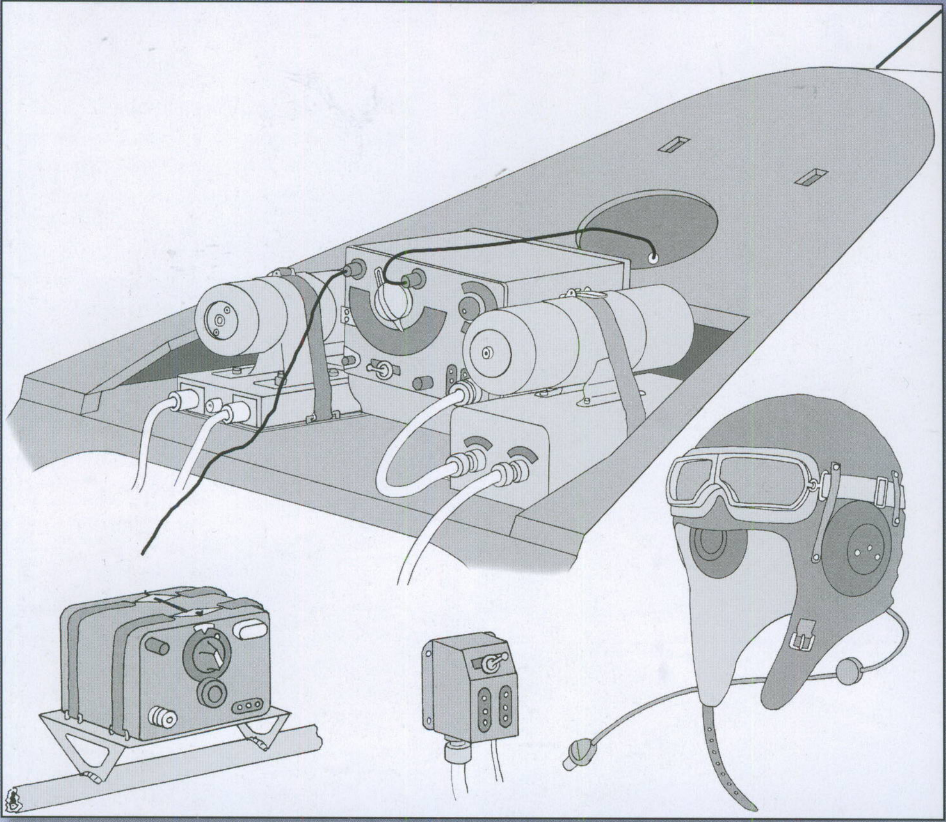
In wartime, all the rear bay appears to be painted dark, probably green as the external surfaces.



***Above**: A detail of the rear bay of a MiG-3 on the production line. Note the oval shape of the smaller holes.*

Above and right. The rear part of the canopy.

All photos Yuri Pasholok



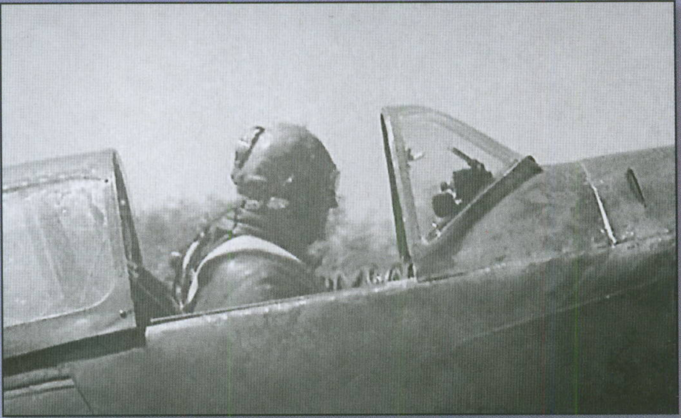
This drawing illustrates the full radio apparatus of MiG-3. In the absence of clear photos of the radio installation on the on MiG-3, is based on the similar equipment fitted to the I-200, Yak-9 and La-7.

***Upper, the rear bay with**: RU-11A dynamotor for RSI-4 radio receiver; it is a DC converter*
RUN-30A dynamotor for RSI-3 (rarely installed)

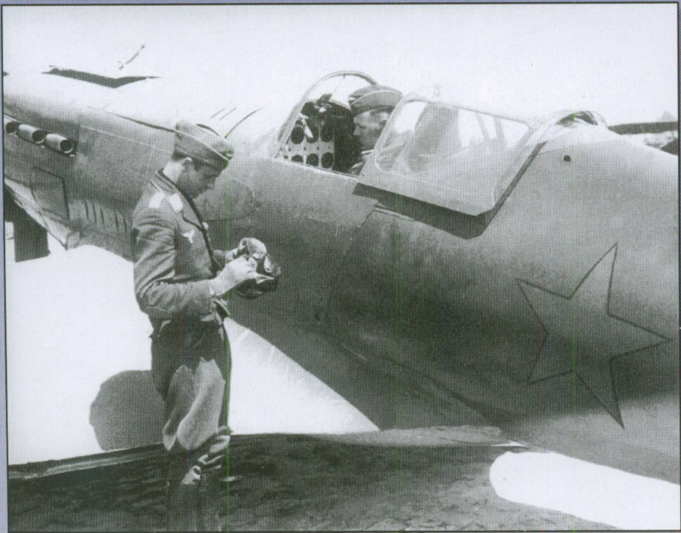
***Lower left:** the RSI-4 radio receiver was located on a small shelf supported by the lower right longitudinal strut, close to the right knee of the pilot. It was connected to the RU-11A dynamotor by a large cable, and to the RSI-3 by a thinner one; probably it was connected to the radio control panel too.*

***Low, center:** the radio control panel was on the right side of the cockpit, close to the pilot's elbow.*
All these boxes had a grounding wire connected to the fuselage frames.

***Low right:** the pilot's helmet was provided with two earphones connected to the receiver, and a throat microphone (probably on the left side) connected to the transmitter.*

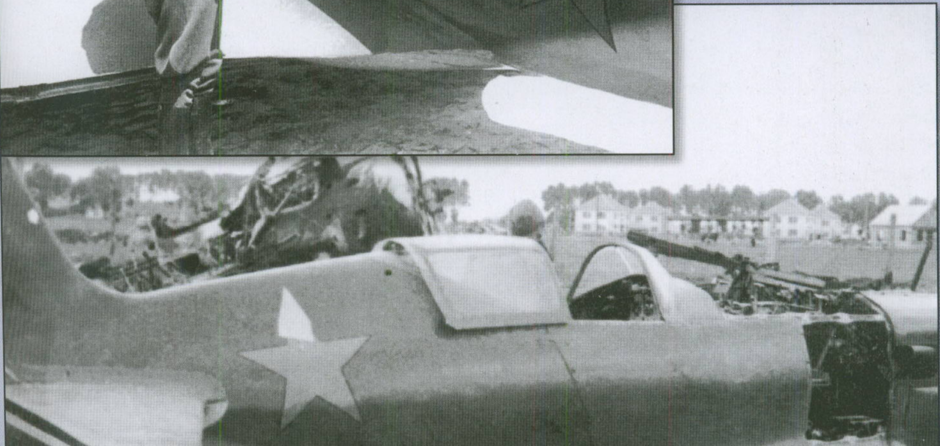


This image shows the gunsight, the lock on the windshield, the cable from helmet to radio and the ring on the nape of the neck of the helmet for retaining the cable while walking.

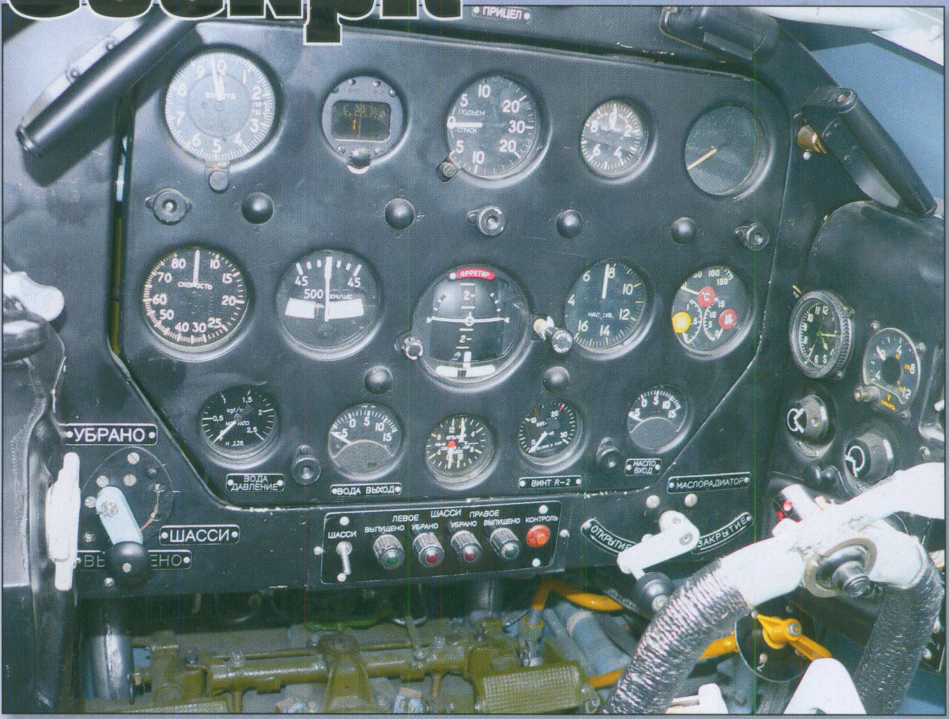


Left and below: Two photos showing the sliding part of the canopy.

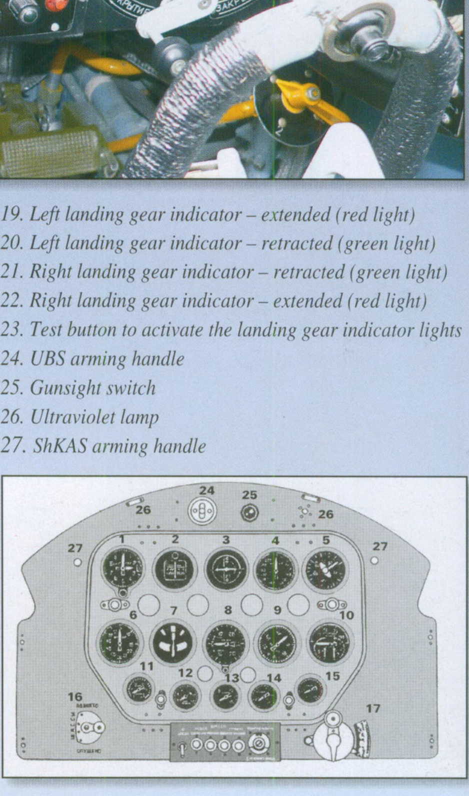
Stratus coll.



Cockpit


ПРИЦЕЛ
АРРЕТИР
УБРАНО
ВОДА ДАВЛЕНИЕ
ВОДА ВЫХОД
ВИНТ R-2
МАСЛО ВХОД
МАСЛОРАДИАТОР
ШАССИ
ВЫ ЕНО
ЛЕВОЕ ШАССИ ПРАВОЕ
ШАССИ
ВЫПУЩЕНО
УБРАНО
УБРАНО
ВЫПУЩЕНО
КОНТРОЛЬ
ОТКРЫТИЕ
ЗАКРЫТИЕ

1. Altimeter
2. Compass
3. Rate of climb indicator (Variometer)
4. Manifold pressure gauge (supercharger?)
5. Fuel gauge
6. Speed indicator
7. Slip indicator (Turn and bank)
8. Artificial horizon (on this restored plane, a 1947 type)
9. Tachometer
10. Oil temperature; Fuel pressure (left); Oil pressure (right)
11. Coolant pressure
12. Coolant temperature from engine
13. Pressure (possibly for gear, left and right)
14. Coolant temperature to engine
15. Oil temperature to engine
16. Main landing gear switch (up-retracted, down-extended)
17. Oil cooler shutters (open-close)
18. Landing gear panel switch
19. Left landing gear indicator – extended (red light)
20. Left landing gear indicator – retracted (green light)
21. Right landing gear indicator – retracted (green light)
22. Right landing gear indicator – extended (red light)
23. Test button to activate the landing gear indicator lights
24. UBS arming handle
25. Gunsight switch
26. Ultraviolet lamp
27. ShKAS arming handle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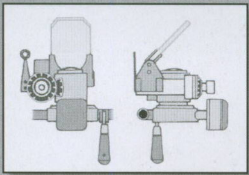
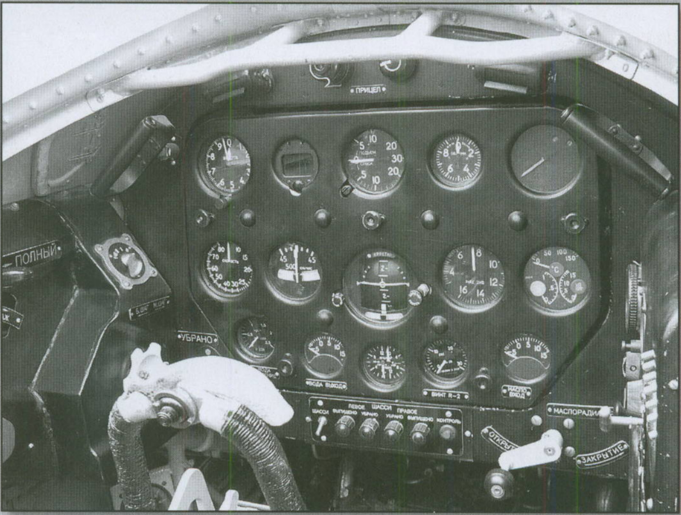
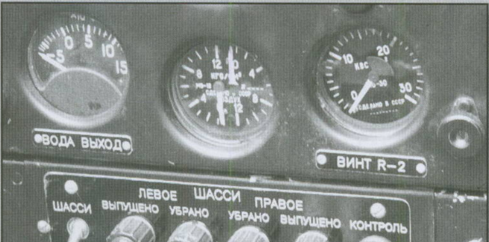
The original colours of the MiG-3 cockpit are still unclear. On B&W photos, one can see that the instrument panel can be either black or light, possibly grey.
The tubular structure is seen both dark (probably dark grey A-14, or olive green, or green as the exterior) or light (perhaps light blue-green primer, or light blue as the undersurfaces), as well as the seat. Inner face of fuselage panels appears light; in the Veesiveehma depot there is a panel with a light blue-green painted inner surface. Green is likely for some boxes, such as radio and electric equipment. Some small details were unpainted.
The compressed air bottle should be black, while the oxygen bottle should be blue. The internal surfaces of the wooden rear fuselage could be painted silver or ALG-1 yellow primer. The example under restoration has different colours: light blue frame, olive green primer floor and lower seat, black seat armor, yellow wooden structure. It isn't clear if traces of old paint on the restored wrecks have been found. On most restored Polikarpovs, green and light blue are the dominant colours in the cockpit.



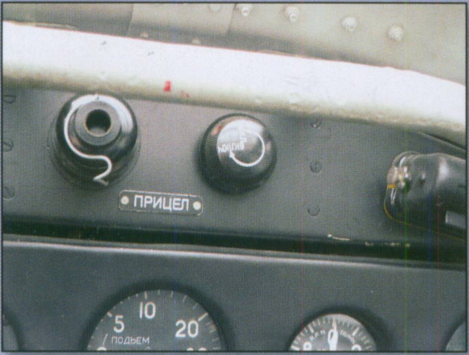

ПРИЦЕЛ
ПОЛНЫЙ
УБРАНО
ВОДА ВЫХОД
ВИНТ R-2
МАСЛО ВХОД
ЛЕВОЕ ШАССИ ПРАВОЕ
МАСЛОРАДИ
ОТКРЫТ
ЗАКРЫТИЕ

A general view of the instrument panel.
The tubular frame is for mounting the gunsight.

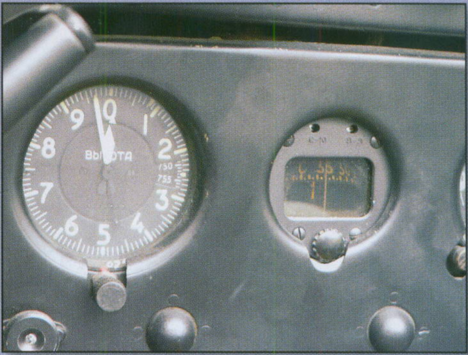

ВОДА ВЫХОД
ВИНТ R-2
ЛЕВОЕ ШАССИ ПРАВОЕ
ШАССИ
ВЫПУЩЕНО
УБРАНО
УБРАНО
ВЫПУЩЕНО
КОНТРОЛЬ

***Upper row from the left**: coolant temperature from engine; pressure; (for gear, left and right?); coolant temperature to engine.*
Lower row, from left to right:
landing gear panel switch; left landing gear down light; left landing gear up light; right landing gear up light; right landing gear down light;
control button
The landing gear lights are on only when the control button is pressed.

All photos Yuri Pasholok


ПРИЦЕЛ
5
10
20
ПОДЬЕМ

From left to right: *UBS armament switch; gunsight switch;ultra-violet lamp*


ВЫСОТА
9
10
1
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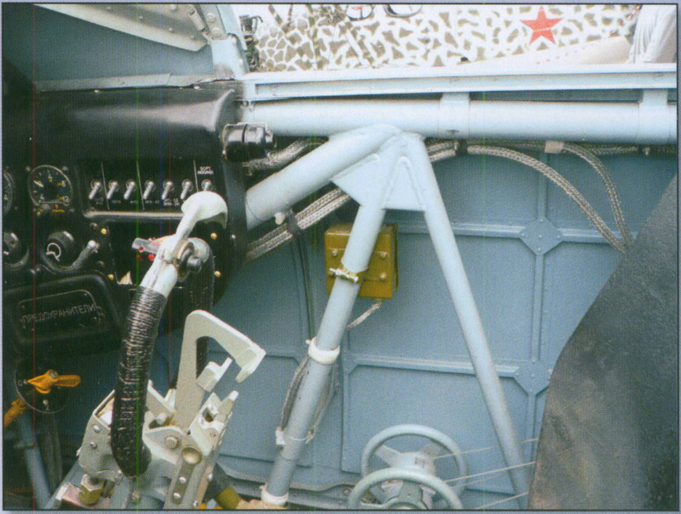
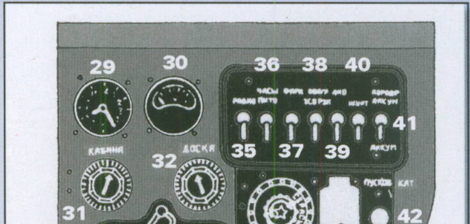
3
4
5
6
7
8

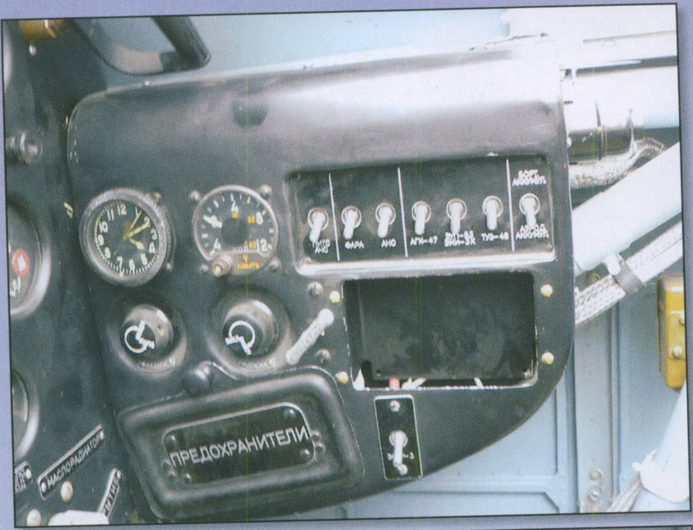
The altimeter (left) has two hands: the short one for thousands of meters, the long one for hundreds. To the right is the compass.



This general view of the right cockpit side shows:
the electric panel,
the control column,
the steel tube strut and the canopy sliding guide on it, (the triangular reinforcement sheets on the frame were not present on wartime planes)
the trim wheels, for the tabs on of the rudder and the right elevator;
the armoured backrest, 9 mm thick.
The oxygen system is absent on this rebuilt plane, as are the radio receiver, the signal pistol and the racks for its rounds and a document holder).

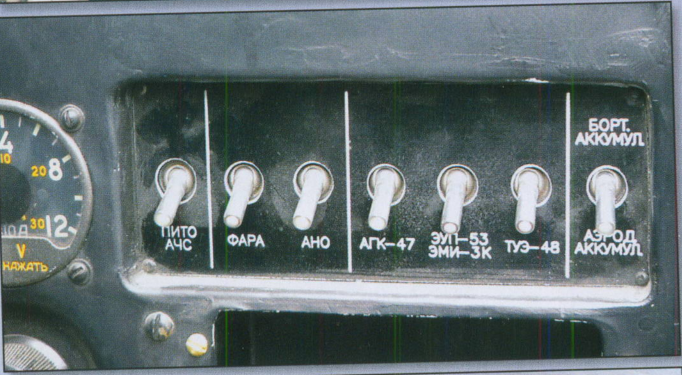
All photos Yuri Pasholok


29
30
36
38
40
41
35
37
39
АККУМ
КАБИНА
ДОСКА
32
31
ПУСКОВ
КАТ
42
33
34
ПРЕДОКРАНИТЕЛИ
43

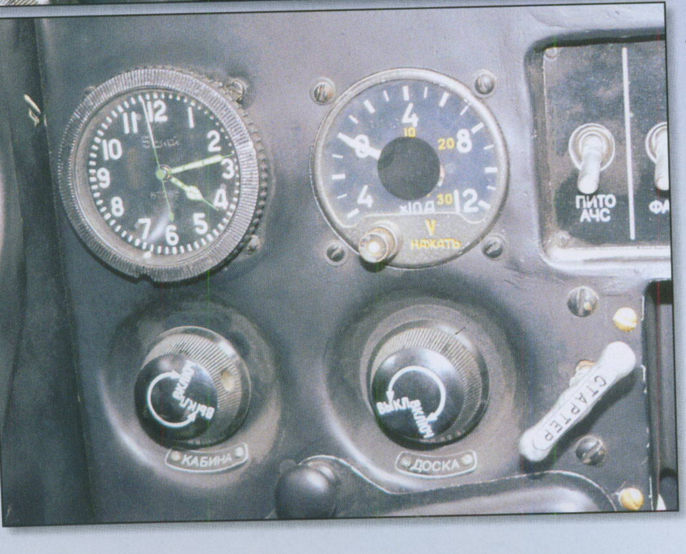

ПИТО АЧС
ФАРА
АНО
АГК-47
ЭУП-53 ЭМИ-3К
ТУЭ-48
БОРТ. АККУМУЛ.
АЭРОД. АККУМУЛ.
ПРЕДОХРАНИТЕЛИ
МАСЛОРАДИАТОР
НАЖАТЬ

The electric panel.
The black rectangle at the bottom is the safety lock for electric panel.
The empty rectangular space was for bomb and rocket controls.

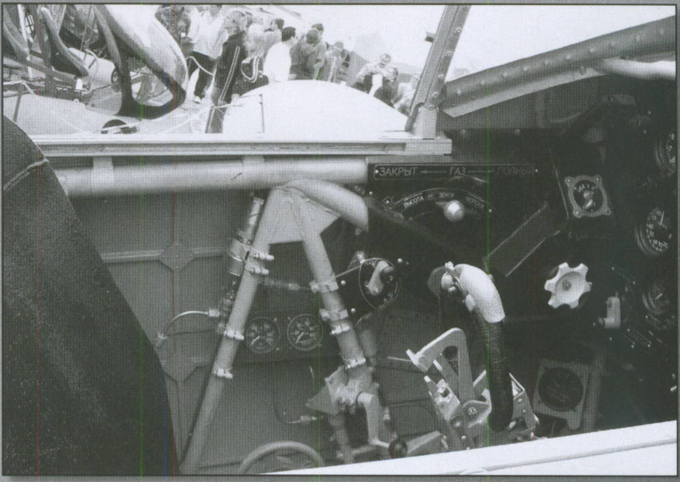
29. Clock
30. Ammeter
31. Cockpit lightning switch.
32. Instrument panel lightning switch
33. Bomb salvo selector
34 safe lock for bombs or rockets (Not confirmed)
35. pitot switch
36. landing light.
37. navigation lights
38. Electricity circuit –ON
39. Aircraft navigation lights
40. Switch ON
41. battery (up: from the plane; down: from the ground)
42. Rocket launch.


ПИТО АЧС
ФАРА
АНО
АГК-47
ЭУП-53 ЭМИ-3К
ТУЭ-48
БОРТ. АККУМУЛ.
АЭРОД. АККУМУЛ.
НАЖАТЬ

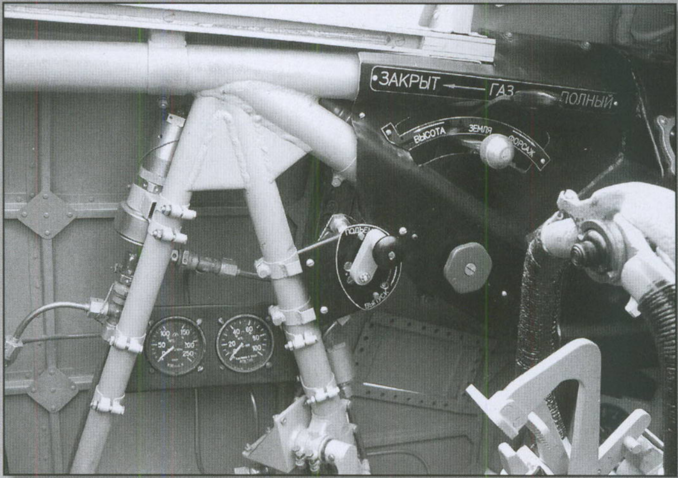
***Middle**:*
switches, from the left: pitot; landing light; navigation lights; unknown; unknown; unknown; battery :
up: from the plane
down: from the ground


ПИТО АЧС
НАЖАТЬ
КАБИНА
ДОСКА
ВЫКЛ ВКЛ
СТАРТЕР

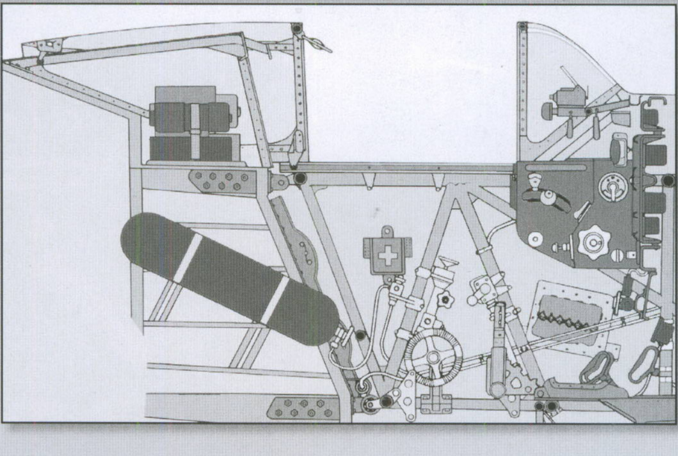
***Bottom**:*
upper row:
clock; ammeter (white scale) and voltmeter (yellow scale); switches
lower row:
cockpit lights; instrument panel lights; engine starter (probably absent on wartime planes)



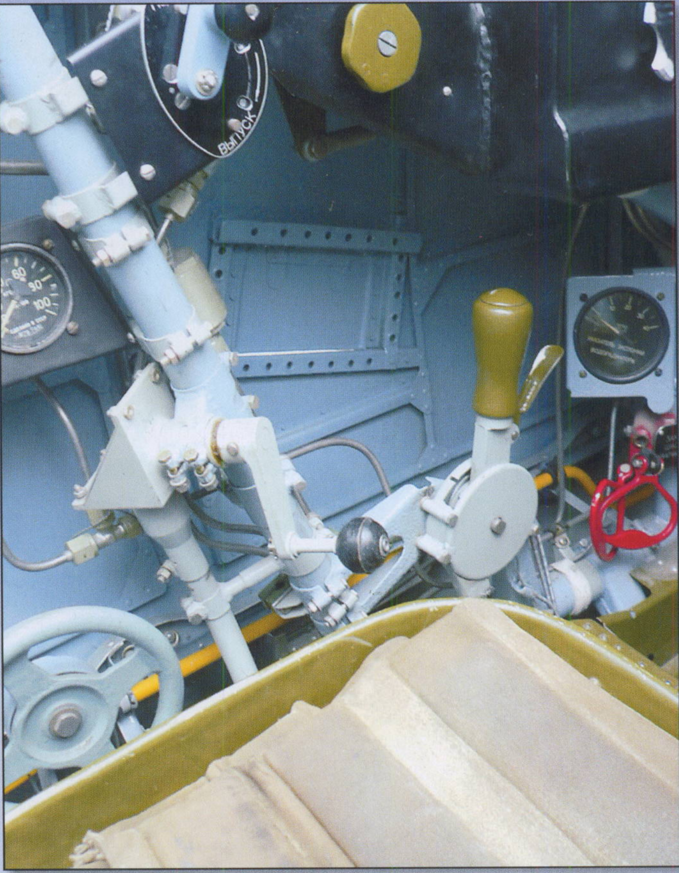
This overall view of the left side of cockpit of the restored plane shows:
the steel tube strut with the canopy sliding guide,
the armoured backrest,
the control column
the throttle panel.



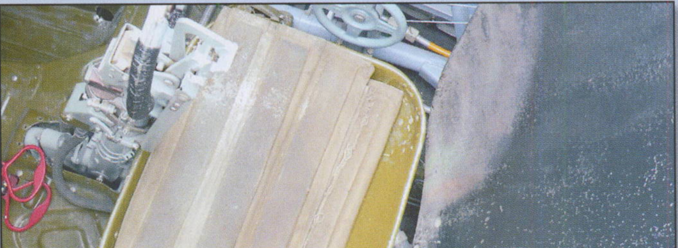
The metallic pipes and cylinder are part of the pneumatic system.
The indicators are two manometers, one for bottle pressure, the other one for pipe pressure.
A comparison with wartime photos show slightly different positions for all these pneumatic elements.
A black compressed air bottle should be on the left side, behind the seat.



This section shows details of wartime MiG-3s.
On the left side of cockpit we see, amongst other things:
the compressed air bottle, connected to the regulator and filter;
the first aid pack;
the bag on the internal side of footstep.
The handle in the centre of the sliding hood is characteristic of early type MiG-3s; on later types it was replaced by the lock on the right frame.

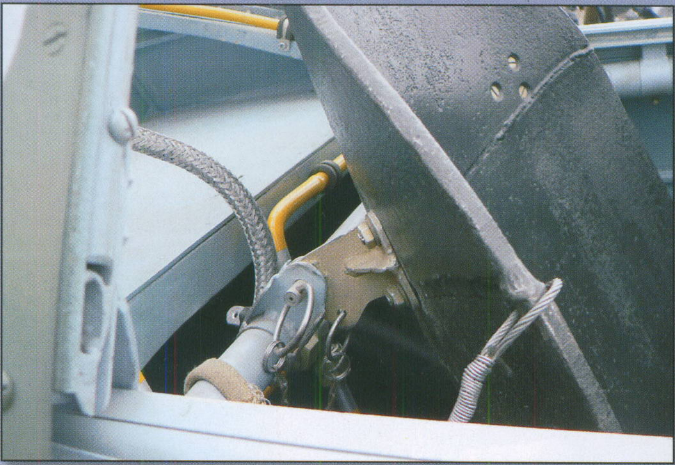


The lever on the oval black plate is for wing flaps control. Flaps are pneumatically actuated.
The light grey crank is for water cooler outlet flap control. The position of the cooler outlet flap can be seen on the indicator close to the red handles on the right.
The trim wheel on the left controls the trim tab on the left wing aileron.
The footstep door is visible on the wall; on wartime planes it was closed by a cloth bag to prevent mud access to the fuselage.
The lever with a greenish handle is for tail wheel retraction.
All photos Yuri Pasholok

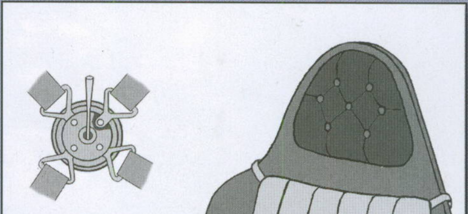


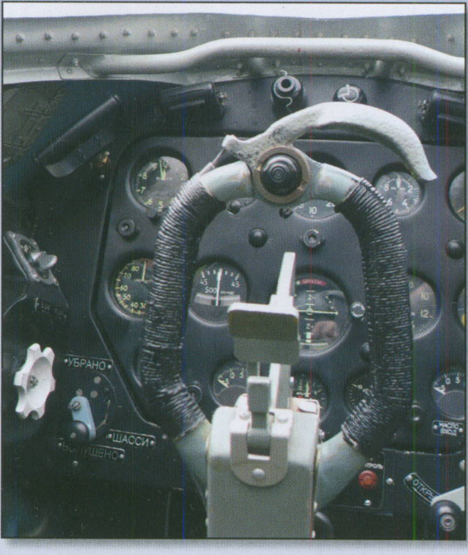
The seat is composed of two elements: the lower one, visible in the center of the image, is concave to contain the parachute bag, on which the pilot sits.
The khaki cloth could be the removed backrest cushion.
The rear armoured plate and backrest is visible on the right of the image.
No seat belt is visible.
The corrugated black object under the seat could the ventral fuel tank.

Here we see the backrest and its supports.
A horizontal weld is visible on the backrest.



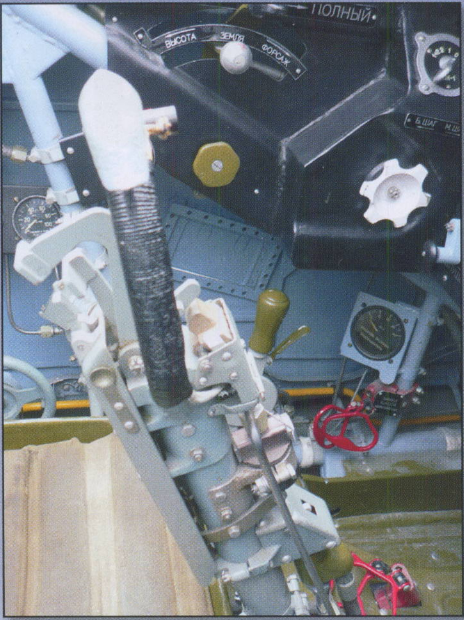
***Middle**: This sketch shows the likely arrangement of the seat belts and cushion.*
This sketch was drawn from factory sketches, photos and similarity to other Soviet planes. The backrest belts pass between the cushion and the armoured plate; they are connected to a wire leading to a reel located on the lower part of the armoured plate. This reel can be locked and unlocked by mean of a small lever on the front-left corner of the seat. Two further belts are connected under the seat, and often fall outside the seat itself when the pilot is out of the cockpit
The belts were made of brown leather.

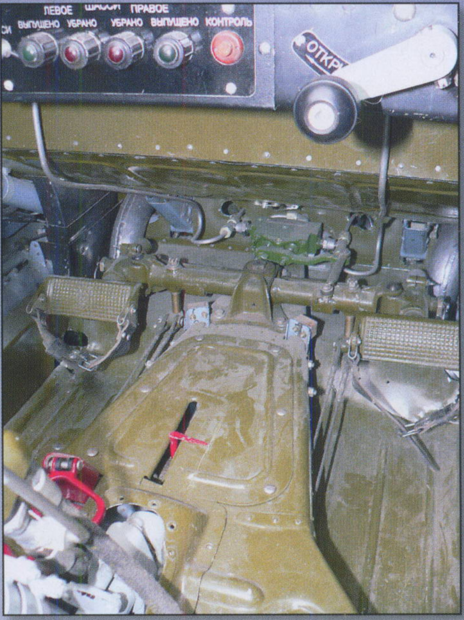




***Left**: The control column. The upper lever is for wheel brakes. The black button is for radio (transmit/receive) Other levers and buttons are for the armament.*
The 'spade-grip' was typical of fighter planes at the beginning of the war, and is seen on the I-16 and LaGG-3 too. At the top, the support for the gunsight is seen. The gunsight itself is not installed.

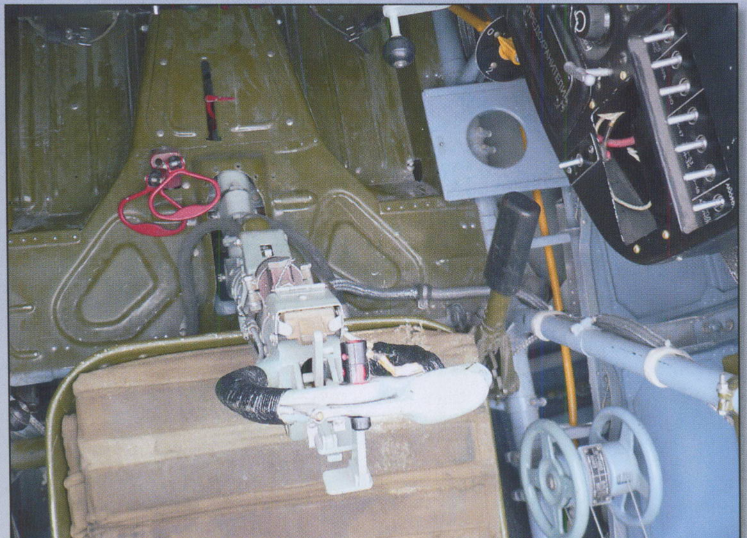
All photos Yuri Pasholok





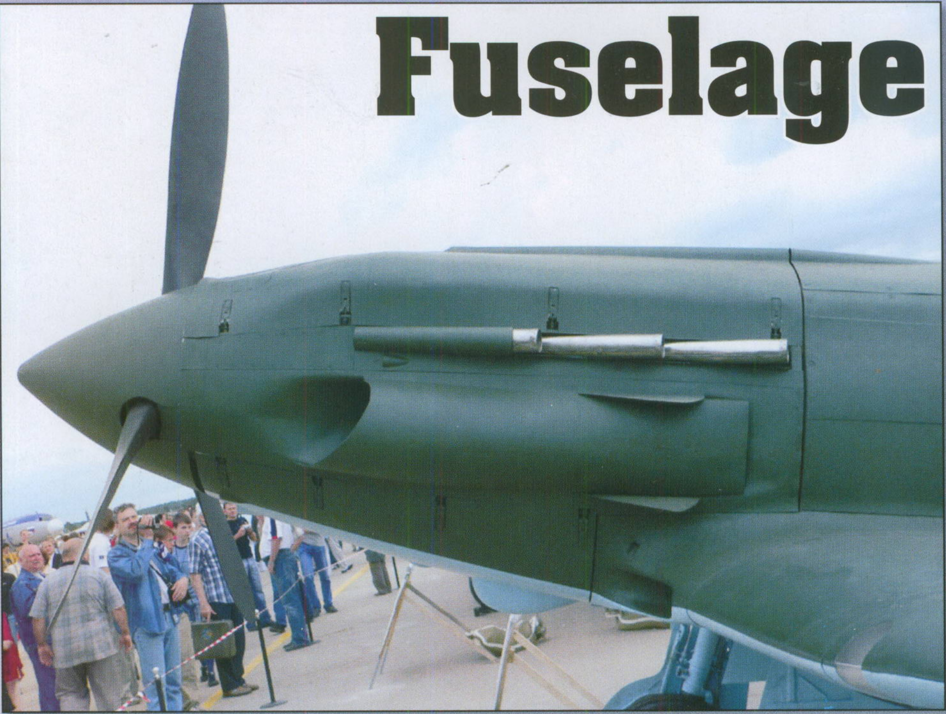
Above, left:
The control column seen from the right. The vertical metallic pipe is for the brake cable. The red handles on the floor are for emergency release of the landing gear.

Above, right:
The floor and the pedals are visible. Pedals are contained in recesses on the floor. Each pedal has a small strap over the foot.



***Left**: The floor where the control column enters in a slot. The floor doesn't extend under the seat, that is supported by an adjustable tube strut. The floor starts where the seat ends. Note the wide space between the strut and the side fuselage panels. The seat adjustment lever (green and black) is visible on the right of the seat. The light blue plate with the hole, is the radio receiver support; the radio itself is not yet installed*

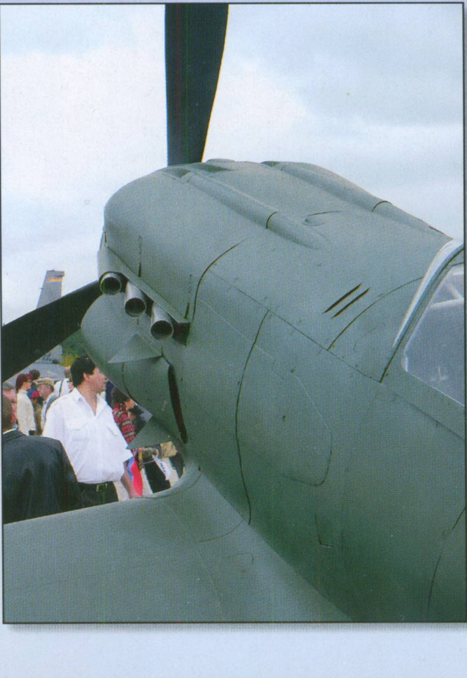
Fuselage



Above: This images show details of the plane rebuilt by Aviarestoration.

The fairing on the first exhaust stack was characteristic of late type MiG-3, and was introduced in production during the summer 1941. The small intake under the exhaust stacks is for cooling the wires of the spark plugs. The large intake is for the left oil cooler tunnel.

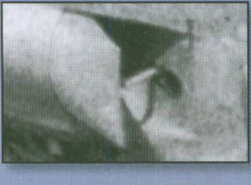
The prop turns clockwise (seen from the front). The bubble-like protrusion under the nose houses the oil and coolant pumps. A hole at the front provides some cooling. On this rebuilt plane with AM-38 engine, the bubble protrudes more than the original one.



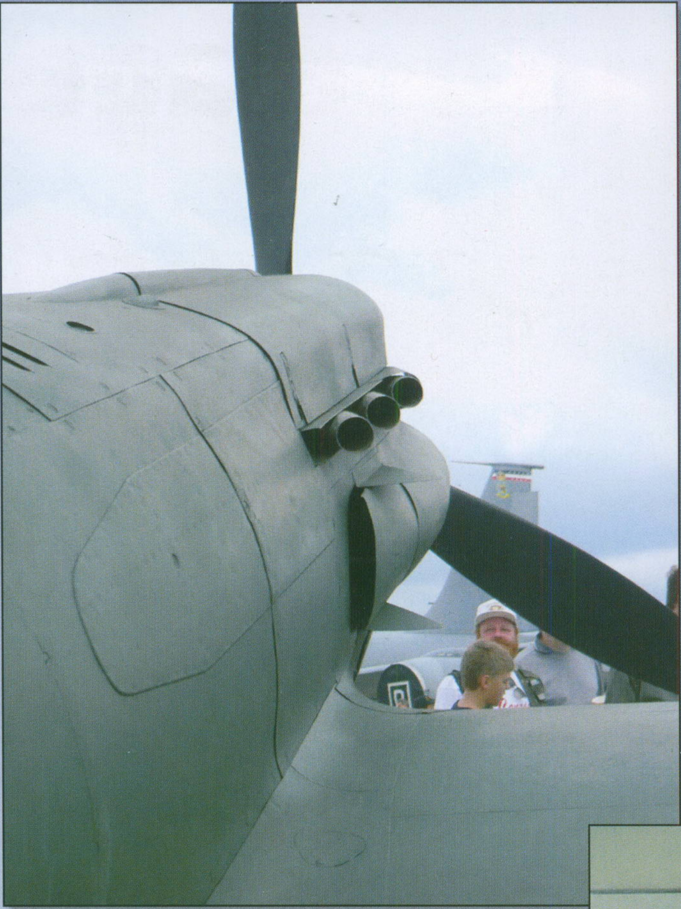
Right: The long fairings on the barrels of the side ShKAS 7.62 mm machine guns are characteristic of late type MiG-3s. This allowed replacement of the ShKAS with two UBS 12.7 mm machine guns or even with ShVAK 20 mm guns. The two small slots should be both for gun cooling and for windshield de-icing.

Note the metal plates above and below the exhaust stacks.

Both photos Yuri Pasholok.

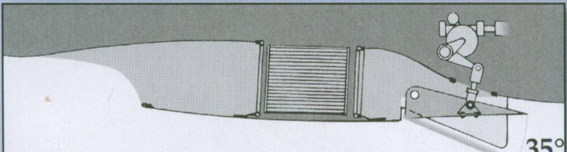


Above: *In this detail of a wartime photo, one can see an actuating rod protruding from a slot to move the oil cooler shutter. The triangular plates are not visible because this was an early type MiG-3.*

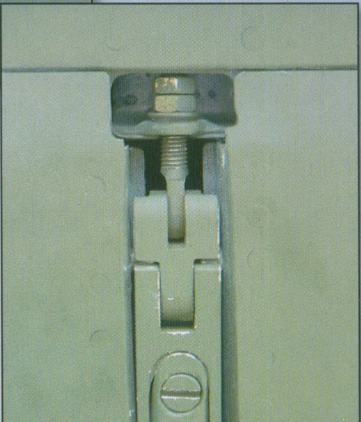


Left: *The side plates behind the exhaust stacks were reinforced by a steel plate.*
Each exhaust stack collects the fumes from two cylinders.
The stacks are still new and shining.
The movable outlet flap of the oil cooler is evident, as are the triangular plates sealing its sides, that were introduced on the late type MiG-3.

Yuri Pasholok



Above: *Section of the oil cooler tunnel, showing the cylindrical cooler and the outlet flaps actuating mechanism. It was a screw gear moved by a crank on the instrument panel.*

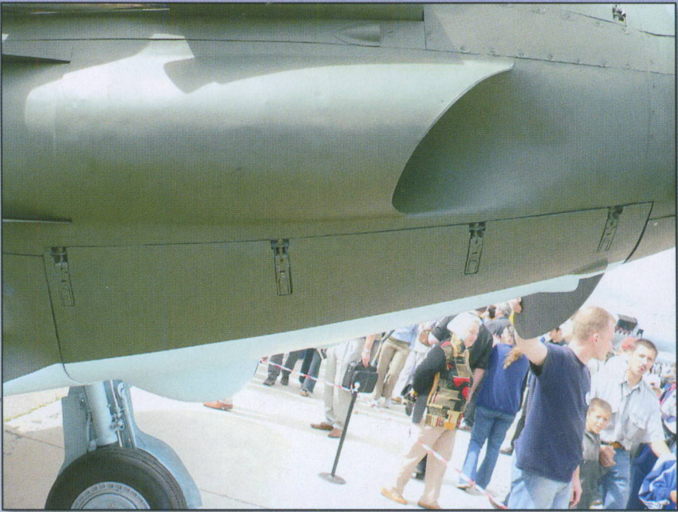


Right: *These quick-release fasteners were introduced on late type MiG-3s during the summer of 1941. The earlier version was provided with Dzus locks on all the panels, and the engine cowling was different.*

Yuri Pasholok

Note that the intake lip of the right side oil cooler tunnel has a different shape from that of the left side. This was to take advantage of the propeller-driven airflow vortex forcing the air down on the port, and up on the starboard sides.

Yuri Pasholok



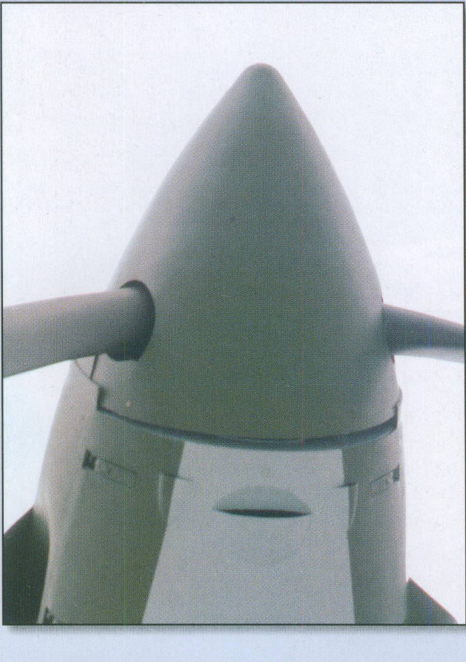
***Below, left**: Here we see a thin lip covering the gap between engine cowling and prop spinner to prevent the access of snow. The lip covers the upper and side parts of the gap, but it is not on the underside. It partly overlapped the spinner. This lip was not always present on early MiG-3s; sometimes it was extended to the upper part only, and not on the sides. In historical photos, it often appears unpainted shiny metal*

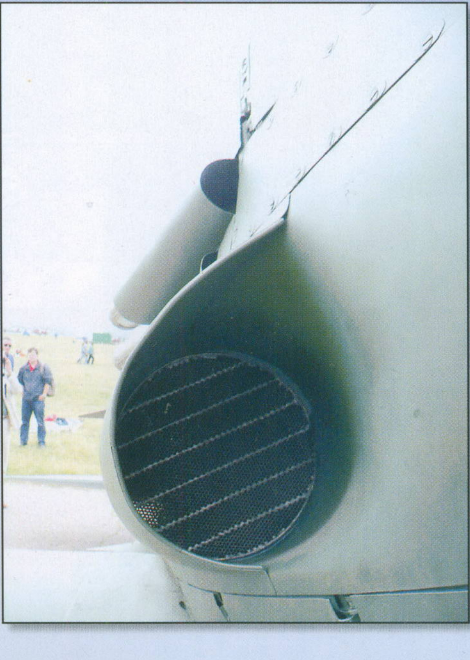
The asymmetry of the oil cooler tunnel inlets is evident.

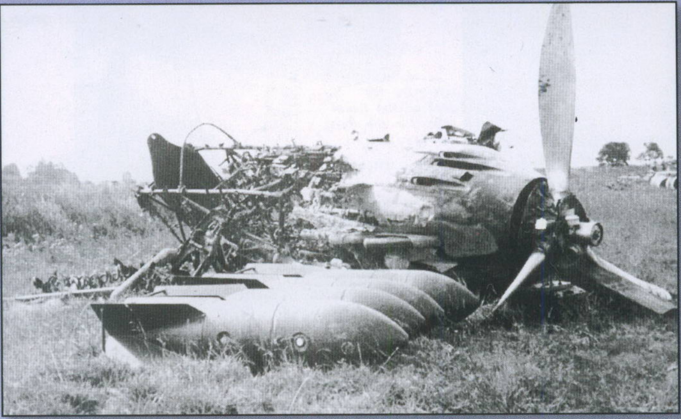
Yuri Pasholok

***Below**: The oil cooler visible inside its tunnel.*

Yuri Pasholok

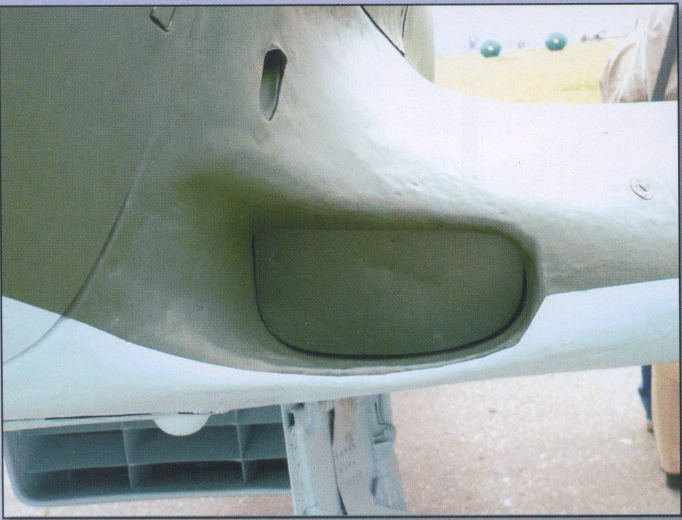






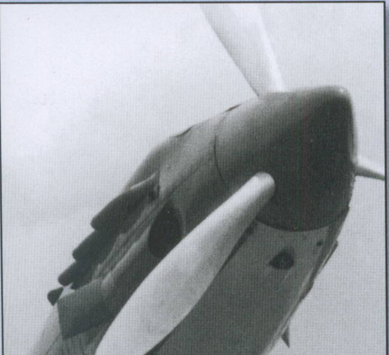
***Top**: The upper part of a destroyed MiG-3. Propeller hub is also visible.*

Stratus coll.



***Middle**: The intakes of the supercharger are located at the wingroots. A small shutter closes each intake when the landing gear is down.*
This shutter opens by rotating backward on a horizontal axis located on its upper side when the landing gear is retracted.
The shutter was introduced on the late type MiG-3. The early model had only a grille.
The smaller hole on both fuselage sides, just above the air intake, is for dischargng the waste shells of ShKAS 7.62 mm guns.
In the background, the baffles on the radiator inlet are clearly visible: two horizontal ones crossed by two vertical ones. The horizontal ones guide the air flow upwards to pass through the whole radiator.

Yuri Pasholok

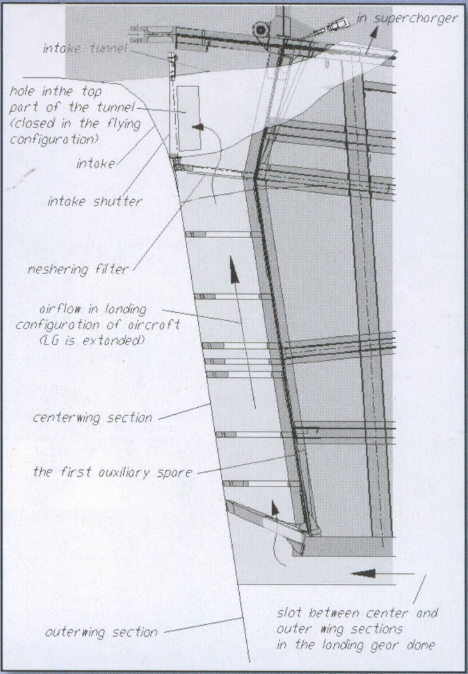


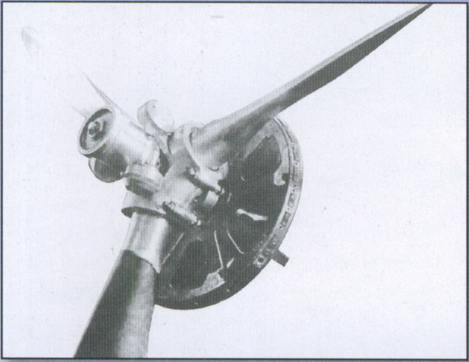
***Left**: This detail from a wartime photo of an early type MiG-3 allows a comparison.*
Note: the right shape and size of the protrusions under the nose (the shape and size of the bubble-like protrusion of water and oil pumps are common to late type MiG-3s; on these later planes the panel line was moved rearward behind the bubble, as on the rebuilt plane);
the cowling-spinner junction without the lip, (that was introduced on later production planes);
the supercharger intakes closed only by a grille of vertical elements with a larger horizontal one; no shutters were provided on early type MiG-3s;
the lack of a tubular fairing on the first exhaust stack;
the lack of triangular plates on the oil cooler shutters;
6 vertical slots on the fuselage sides;
the different paneling and the lack of quick-release fasteners.

Jan Koennig

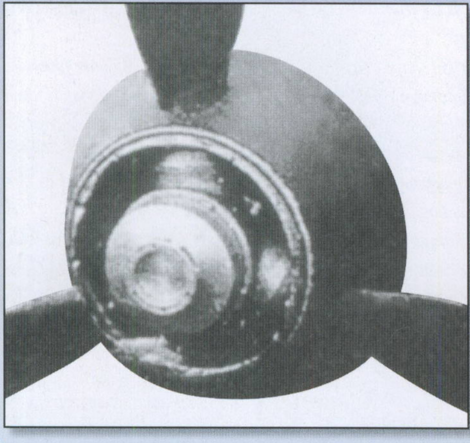
When the landing gear is down, the air intake shutter is in a closed position.
The airflow enters through a slot in the landing gear bay, passes through the struts of the wing leading edge, then across a mesh filter, then enters in the air intake tunnel through a hole in the upper part of the tunnel, just behind the shutter.
Both the hole and the landing gear bay slot are closed when the air intake shutters are open.

courtesy Boris Osetinsky of Aviarestoration


in supercharger
intake tunnel
hole inthe top part of the tunnel (closed in the flying configuration)
intake
intake shutter
meshering filter
airflow in landing configuration of aircraft (LG is extended)
centerwing section
the first auxiliary spare
slot between center and outer wing sections in the landing gear dome
outerwing section

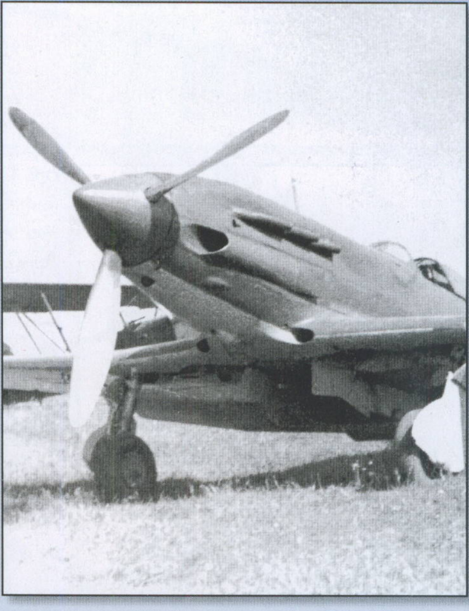


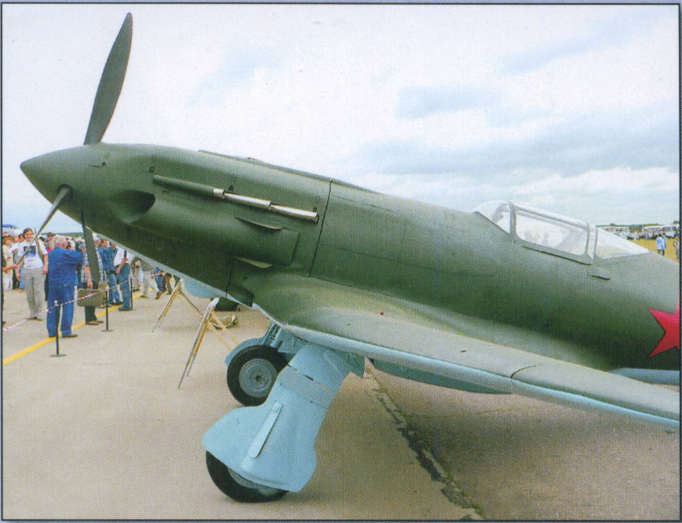
***Above**: The VISh-22E prop of early MiG-3 without the spinner. The propeller blades had a pitch angle range of 20^0. The blades are made of Elektron, a magnesium alloy; the overall diameter is 3.0 m.*
***Below**: the AV-5L-123 propeller of a late MiG-3. The front part of the spinner is missing. The new propeller blades had a pitch angle range of 30^0 instead of 20^0. The hub is different from that of the early type.*



***Below**: Wartime photo of the left side of the MiG-3 early type nose.*

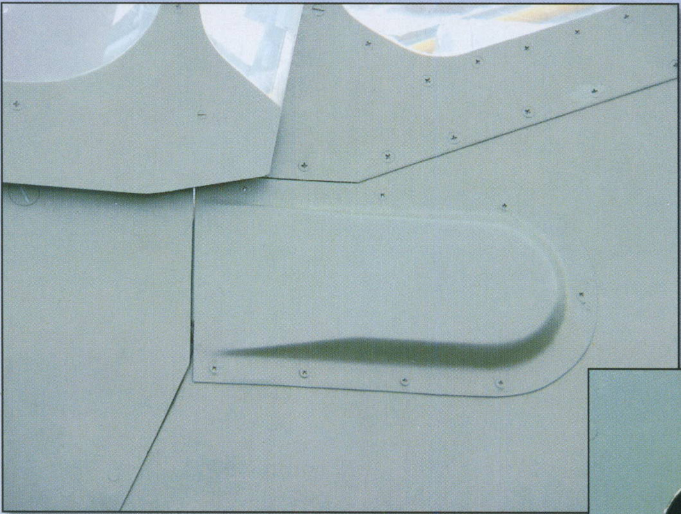
Stratus coll.



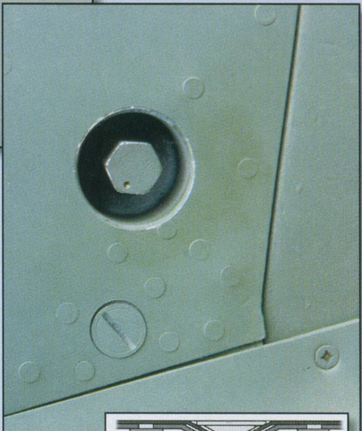


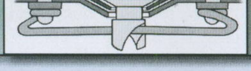
The left side of the fuselage of the rebuilt plane looks very original, except for the lack of a small ventilation hole behind the canopy.

All photos Yuri Pasholok



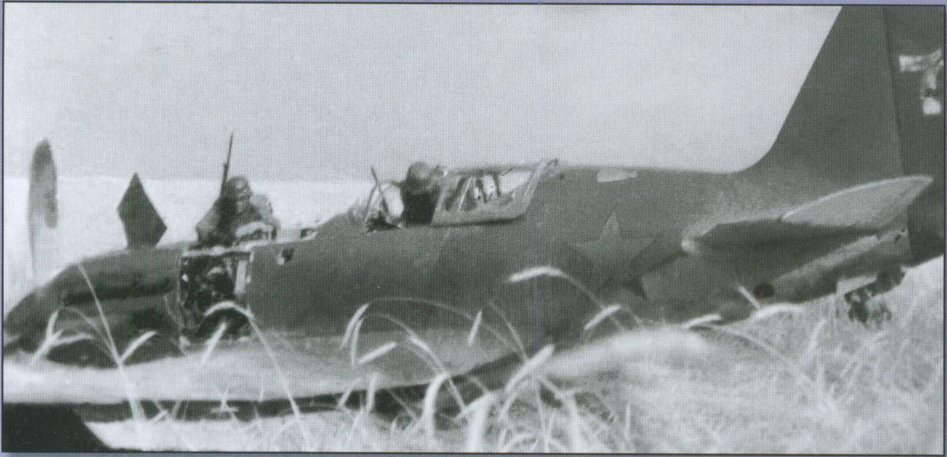
This is the cover over the upper bolts connecting the front and rear fuselage sections, on the left side of the fuselage (it was on both sides). The metal panel under the canopy is to the left, while the wooden rear fuselage is on the right.

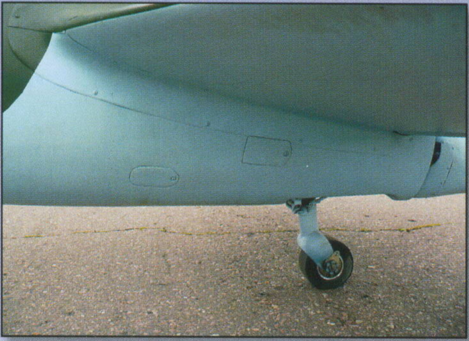


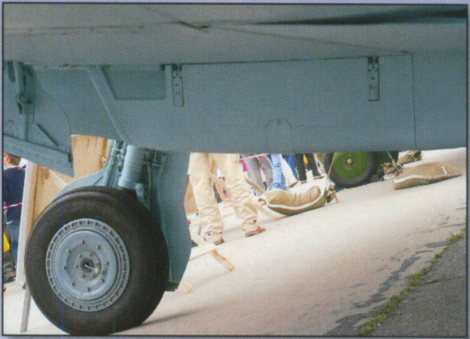


Right: *Right: A detail of the panel on the side, just above the left wingroot. A Dzus fastener is clearly visible at the bottom of the panel. The hexagonal cap is for compressed air refuelling (left side only)*

Bottom right: *A section through a Dzus fastener.*







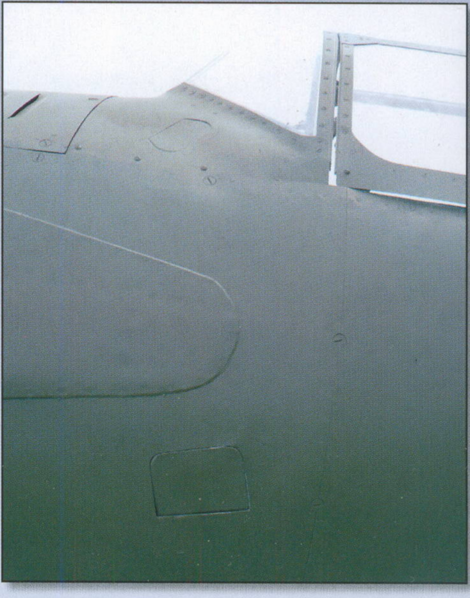
Top*: Port side of the MiG-3, this photo was taken by a German soldier.*

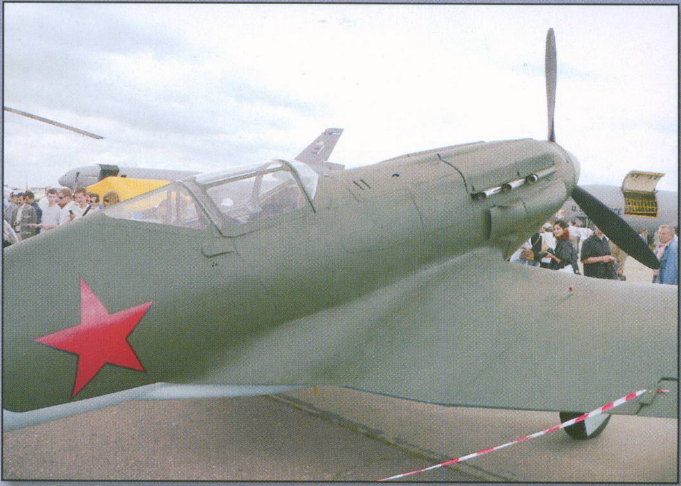
Sratus coll.

Above*: Hatches under the tail give access to the tail wheel retraction mechanism. These hatches are on the left side only*

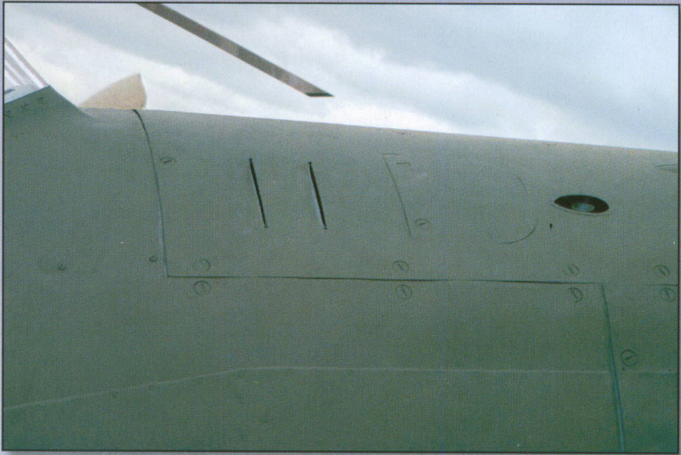
Above right*: The radiator was covered by this long fairing, that included a ventral fuel tank too. It is closed by quick-release catches for quicker access. The trapezoidal recess is the waste shell ejection slot for the UBS machine gun on the left side only.*

Right*: This image of the left side shows:*
The hand grip in front of the windshield; a footstep - on wartime planes, it was closed on the inner side by a bag to prevent mud entering the cockpit. Those details are on left side only. The panel of the windshield was locked by screws instead of Dzus locks, because it wasn't to be removed very often.

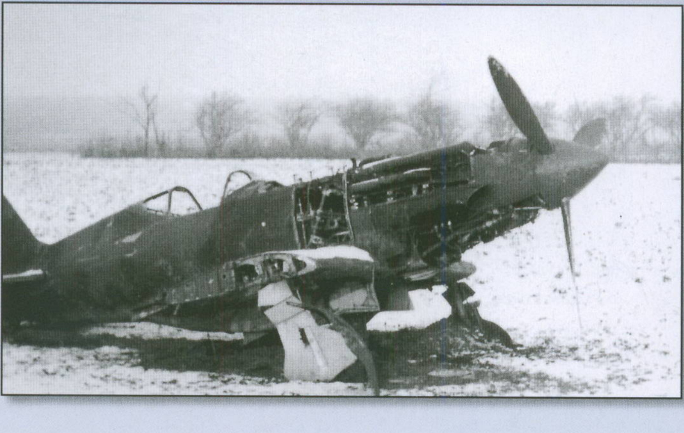




The right side of this rebuilt plane closely resembles the original one, except for some small details in the rear fuselage:
the small holes in a circle, an electric socket, is in different position than on original planes;
a hole for the wire aerial and a small ventilation hole behind the canopy are missing;
and an oval door down position, perhaps for oxygen bottle refuelling, is missing.



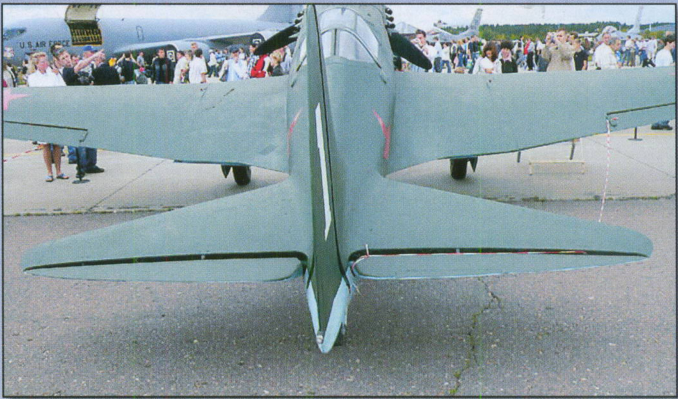
This image shows the aluminium alloy panels that cover the mid fuselage frame. They are joined to supports by dzus locks, that appear similar to large screw heads.
The long oval plate behind the exhaust stacks was made of steel sheet for better resistance to heat (on both sides).
Noteworthy is the slot for the antenna mast (not installed) in front of the windshield, on the right side only, and an oval door, perhaps for oxygen bottle refuelling, is missing.
All colour photos
Yuri Pasholok

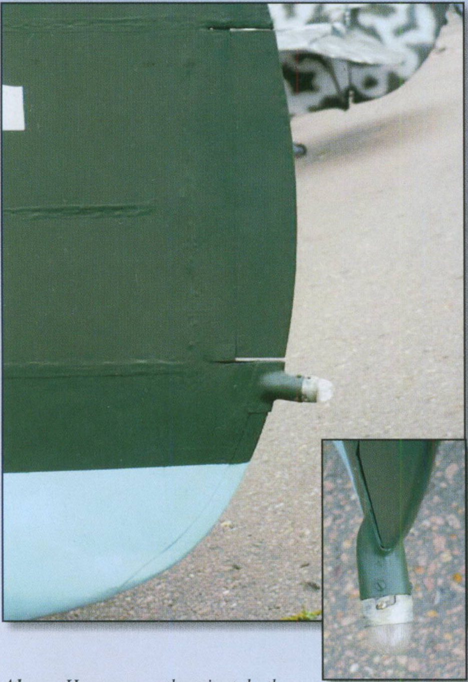


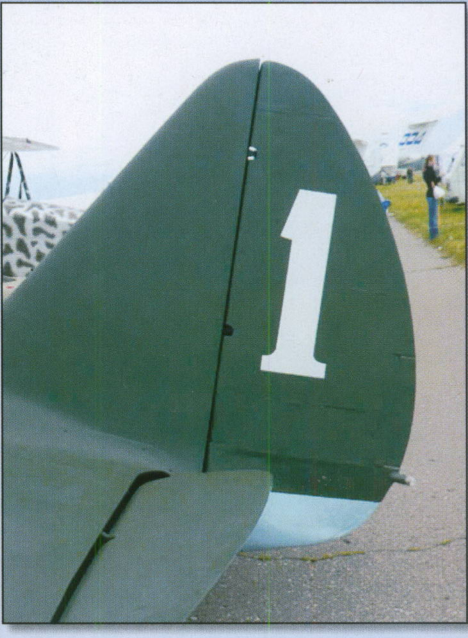
Destroyed MiG-3 with engine panels removed.
Note details of the wing rib.
Stratus coll.

Tail

All photos Yuri Pasholok

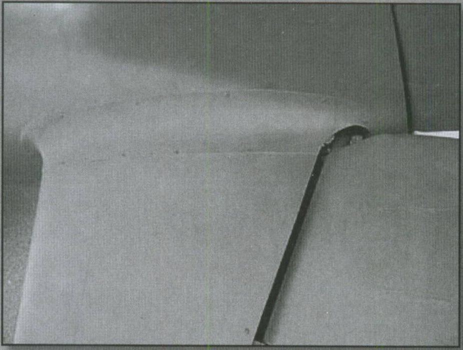


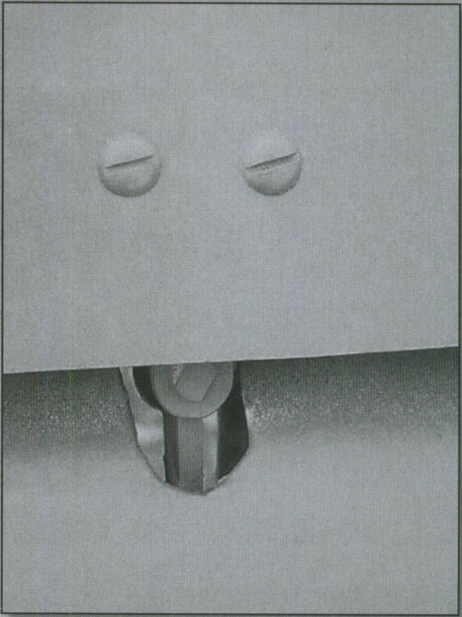




***Above**: Here we see the trim tab, the white tail light and the fabric covered surface.*
The slot between the rudder and the trim tab is covered by thin sheet on its long side, while gaps are visible on its upper and lower sides.
***Inset photo**: The tail light from above.*
Note the round rudder edge.

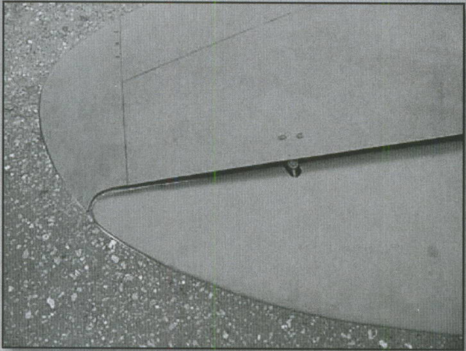
***Above**: The vertical fin, very smooth because it's made of wood and is integral to the rear fuselage (this gave problems of accessibility for maintenance on wartime planes); the rudder has an aluminium alloy structure, covered by fabric except for the lower part, which is metal covered.*

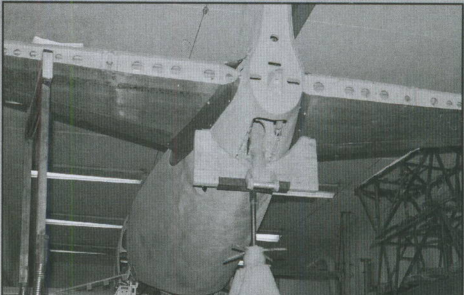




Above: The horizontal tailplane is are made of aluminium alloy, while the elevators have an aluminium alloy structure, covered by fabric. Both elevators are connected by a shaft that passes through a hole on each side of fuselage; the hole is partially hidden by the tailplane root.

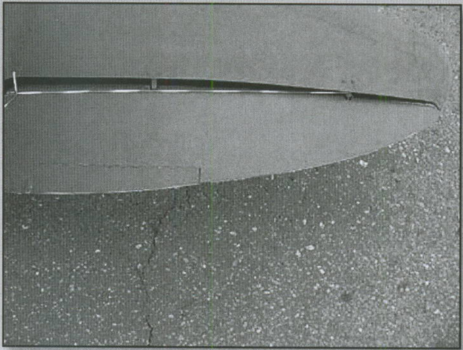
Above right: Detail of elevator hinge.





Above: This view of the plane under assembly shows clearly the lightening holes in the aluminium alloy structure and the holes for the rudder control rod, for the trim wires and the wires for the rear position light. Some details of the tail wheel bay are visible too.

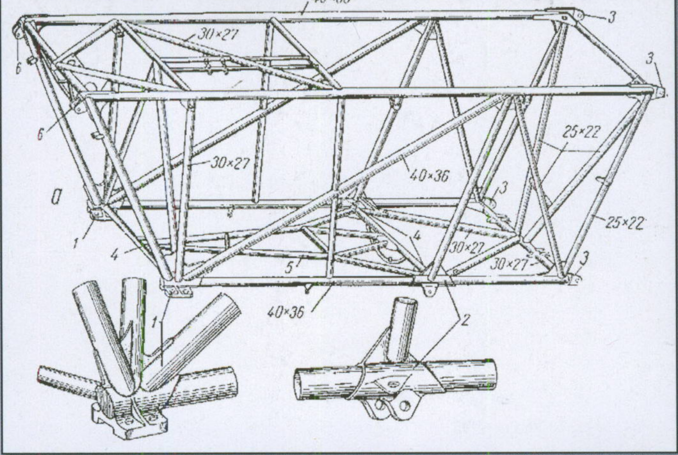
Boris Osetinsky



Left photos: The tailplane tip shape is typical of late type MiG-3. Early types had more pointed tips, as can be seen in this detail from an image of an early type wreck in a Finnish depot. Trim tab on the right elevator only (lower photo). It is actuated by a wheel on the right side of the cockpit.

Internal structure

The internal framework of the mid fuselage is made of welded chrome-molybdenum steel tubes of slightly oval section.


30×27
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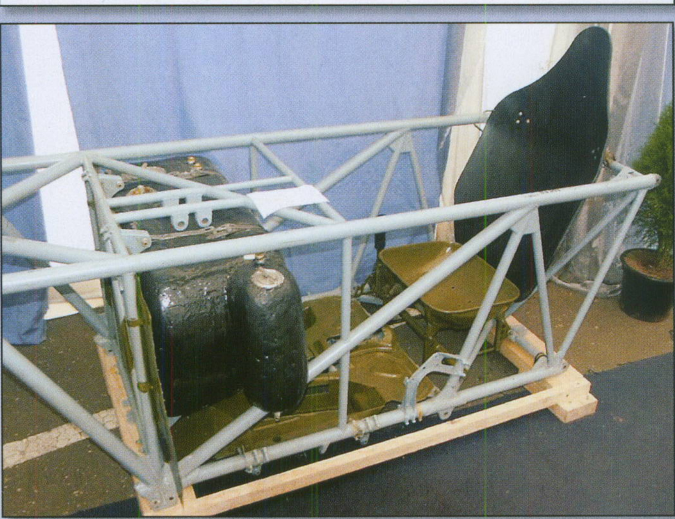
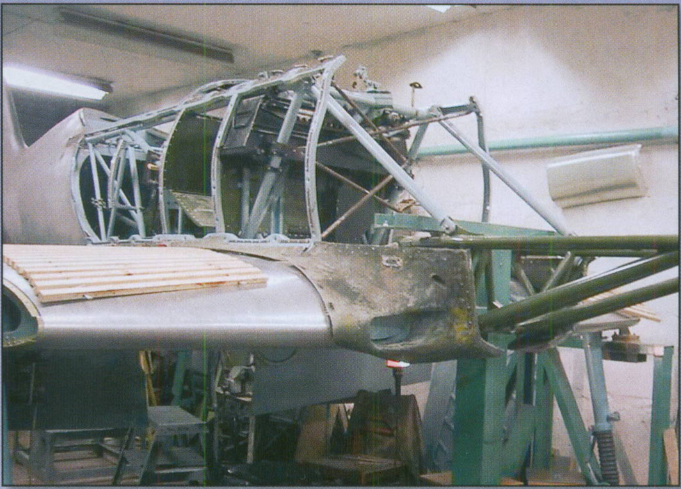


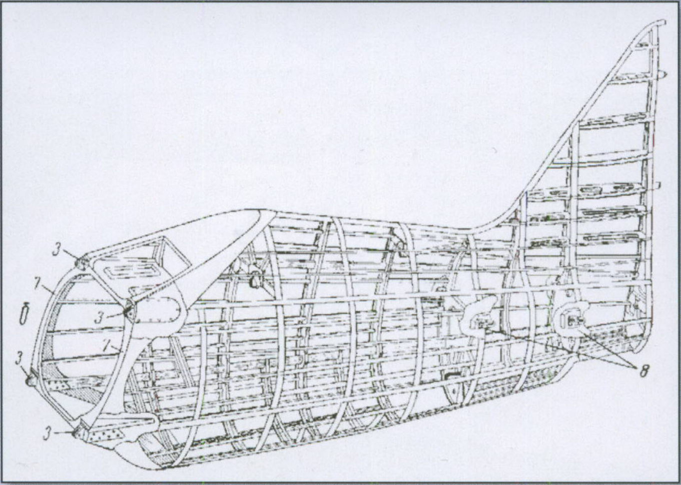
Restored central fuselage frame seen at MAKS 2003 in Moscow. The seat, floor and tanks are already installed. Below, a further detail of the front of the structure showing the fuel cap.

V.V. Dyakonov



On the mid and aft fuselage structure of welded steel tubes, are some shaped structures with small holes. They are for installing aluminium alloy external panels fixed by Dzus-type locks. The central part of the wing was made of aluminium alloys, integral with the fuselage. The tubular structure of the fuselage was connected to the aluminium alloy wing by bolts.

Boris Osetinsky



TThe rear fuselage has a wooden structure covered by birchwood layers.
It is connected to the steel tube frame by 4 bolts (see n.3). The frame is fixed to the wood by plates with two lines of bolts. On the upper plates, the bolt heads (just behind the sliding hood) are covered by a plate. The parts n.8 are connection points for the horizontal tailplane.

from "Construction of aircraft" 1953 edition

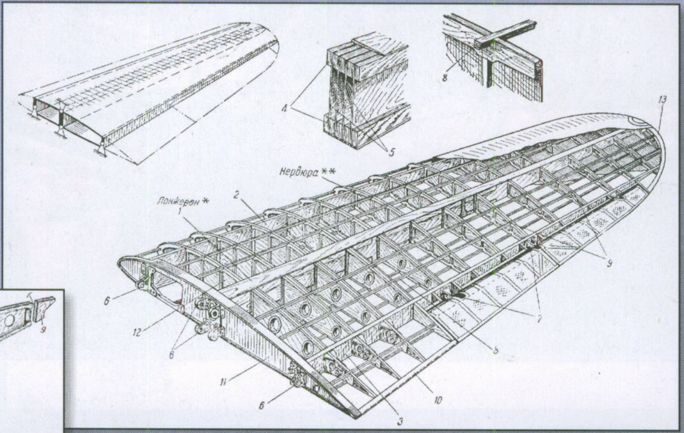
Metal frame of the MiG-3 fuselage as seen in a German photo.

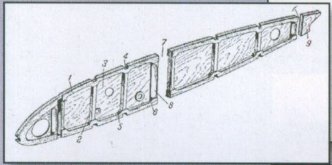
Stratus coll.

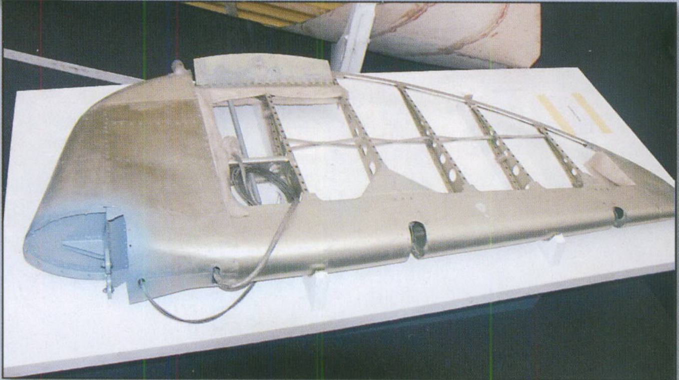
Wing

The outer wings were quickly removeable for transport and maintenance purposes. They were made of wood framework covered by birchwood. The ailerons,like the tail control surfaces, had an aluminium alloy structure covered by fabric. The flaps and slats were made of aluminium alloy.

from "Construction of aircraft" 1953 edition

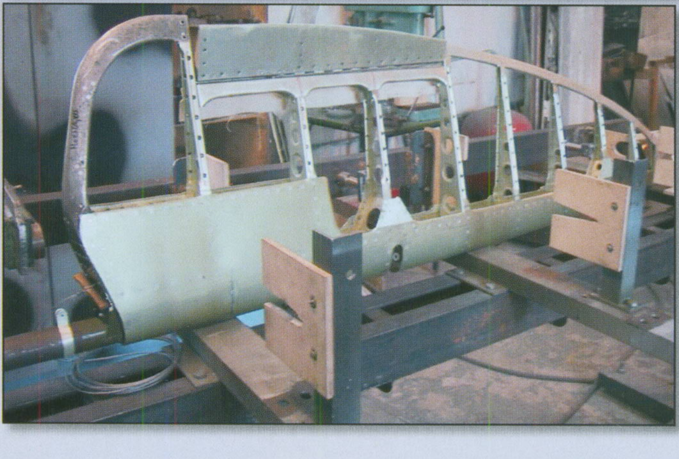






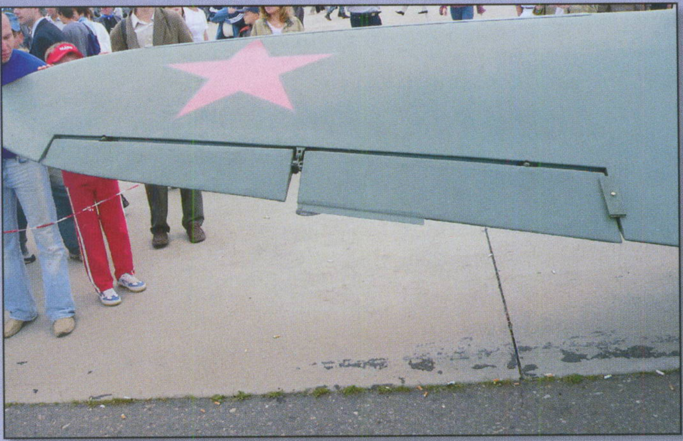
The internal structure of all control surfaces was made of duraluminium. Here we see a nearly complete rudder (missing the lower corner). The trim tab, the hinge recesses and the electric wire for the tail position light are evident.
The small x frames are to give torsional stength to the longitudinal ones.

V.V. Dyakonov



Here we see the structure of the right elevator, the only one provided with a trim tab.
The shaft bottom right connects the two elevators, through small openings in each side of the fuselage.

V.V. Dyakonov

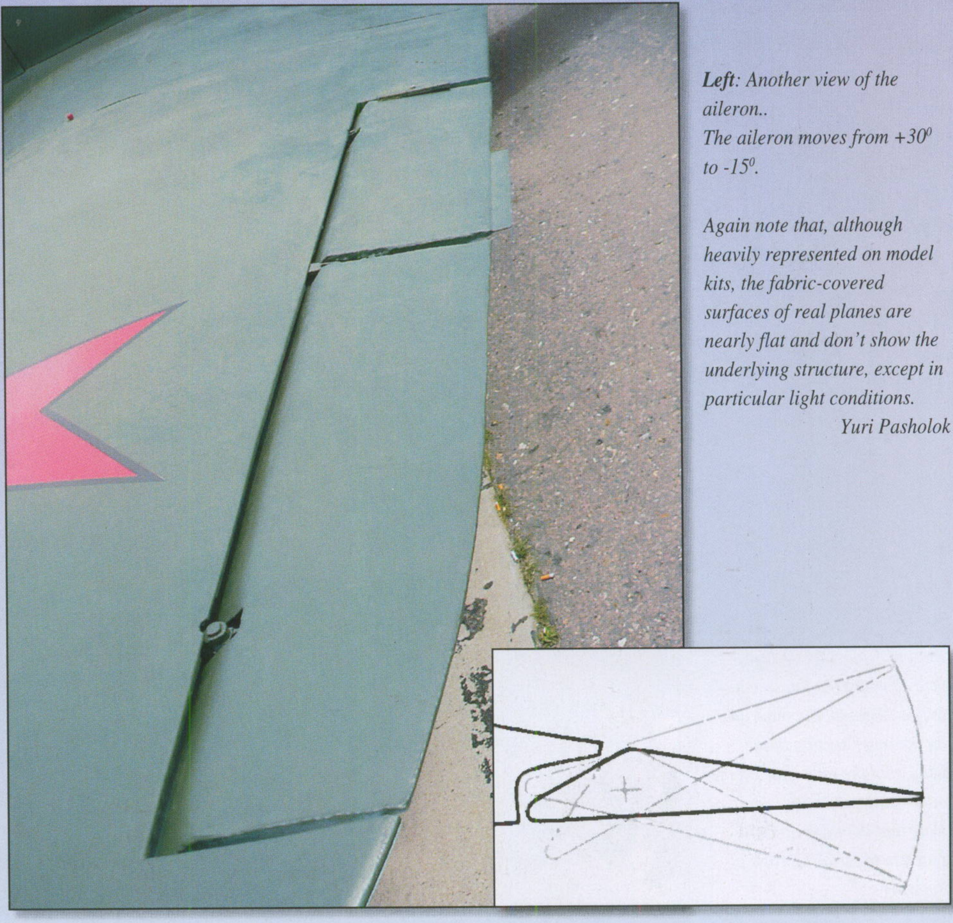


The left wing outer panel. It is made of wood.

The ailerons are clearly visible. The trim tab was on the left wing aileron only.

Also position of the trim tab is not original, see scale plans on page 28.

Note the star on the wing uppersurface, typical of all-green early MiG-3s; this style of marking was never used on wartime late type MiG-3s.

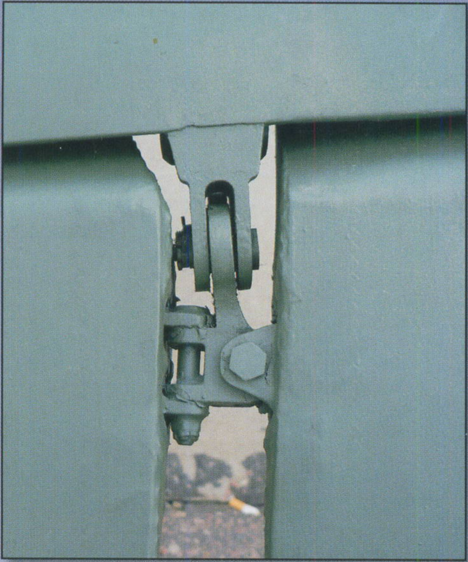


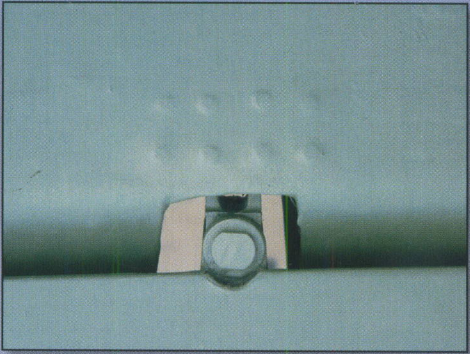
***Left**: Another view of the aileron..*

The aileron moves from +30⁰ to -15⁰.

Again note that, although heavily represented on model kits, the fabric-covered surfaces of real planes are nearly flat and don't show the underlying structure, except in particular light conditions.

Yuri Pasholok



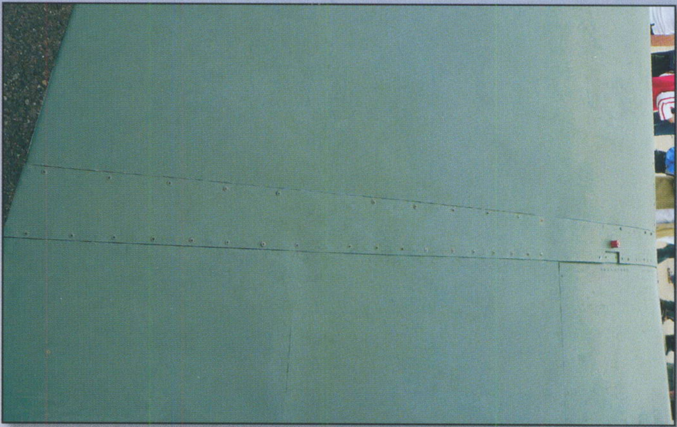


Above: Detail of the inner aileron hinge of the right wing.

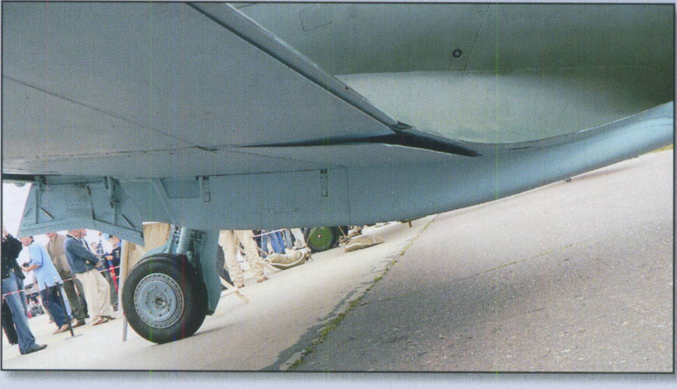
Left: Detail of the hinge joining two sections of the aileron on the right wing.
Note the wide space between the aileron sections.

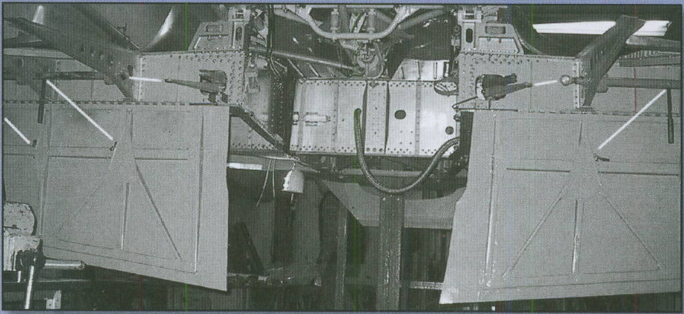
All photos Yuri Pasholok

Right: This metal band covers the joint between the wooden outer wing panel and the metal wing centre section of the left wing.
The red pin indicating the landing gear extension is protruding from the wing uppersurface.

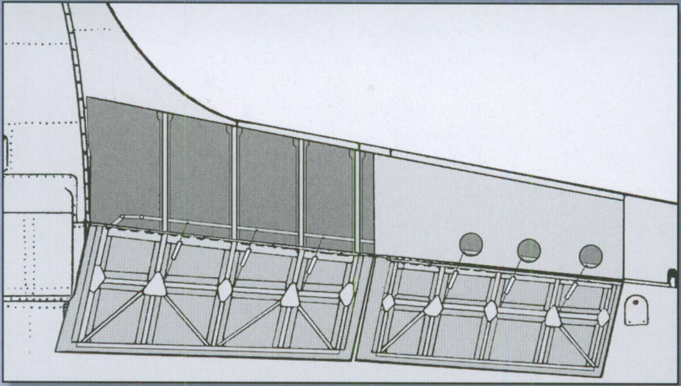


Bottom: The wing undersurface showing the flaps, divided in two sections: the inner one on the inner section of the wing, and the outer one on the outer wing panel.
Note that the flaps do not reach to the trailing edge of the wing.





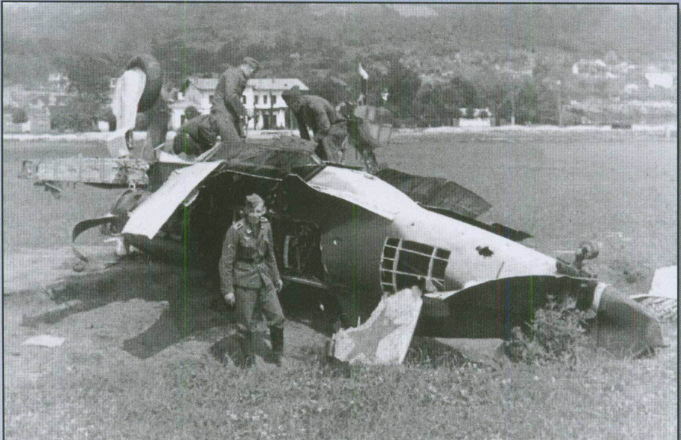
Top: *The flap actuation mechanism: a pneumatically actuated brace moves (by a lever missing in the photo) a long torque tube parallel to the flap hinges of each wing. This tube rotates and moves a series of rods (not connected on this image) that move the flaps. In the image, some unlinked pieces are simulated by white lines.*



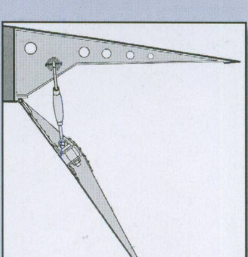
Above: *Drawing of the flap bay and flap internal face. The bay is nearly empty with only 4 ribs on the metal part of the wing, while it is closed by a wood plate on the external, wooden part of the wing. This plate has 3 holes for the actuating rods. There are 3 rods on each section of flaps.*

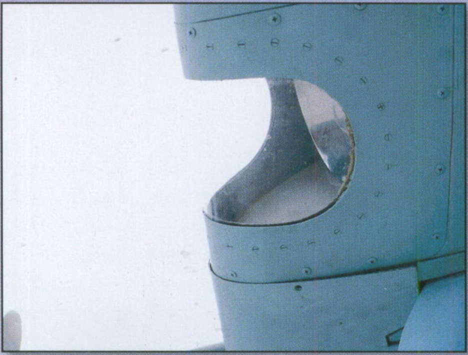
Below: *Wartime photo showing details of the flaps.*

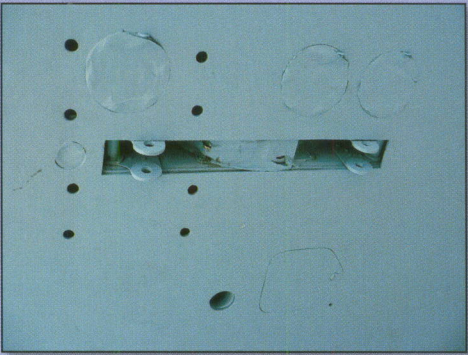
Stratus coll.

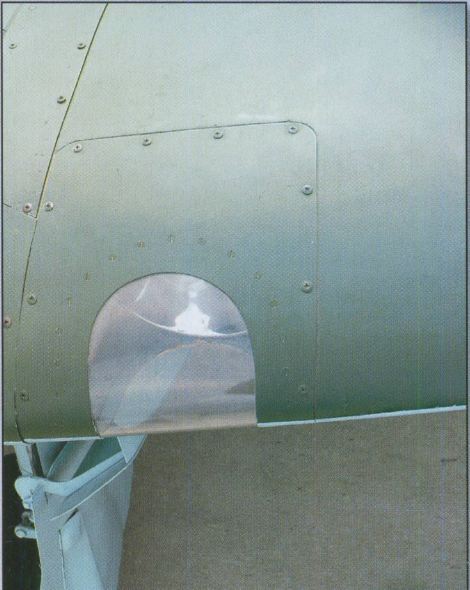


Below: *Section of the flap structure and mechanism.*







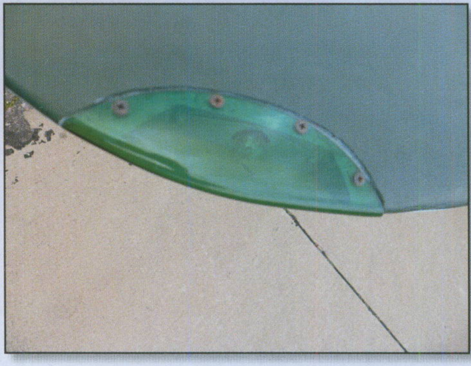


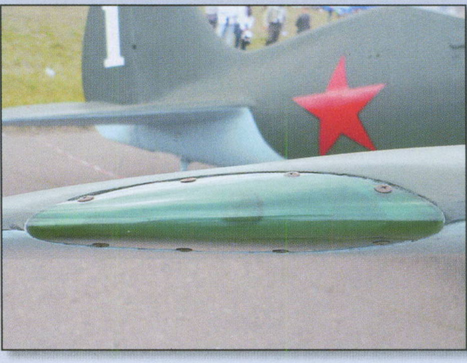
Above right: *The bombs racks and rocket launcher would be attached here.*

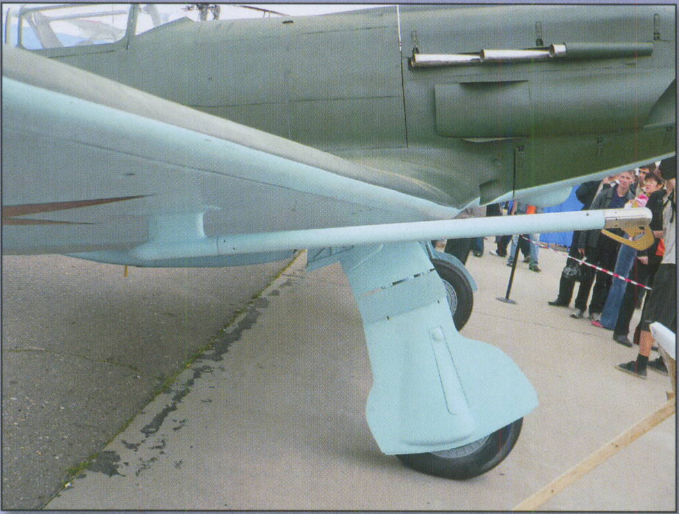
Left photos: *The landing light was on the left wing only.*

Bottom photos: *The right wing navigation light has a clear green cover.*
In wartime planes, the clear cover was usually attached by a thin metal frame.
The left wing light had a red cover.

All photos Yuri Pasholok



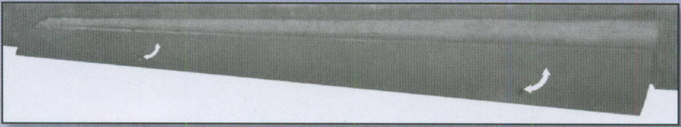




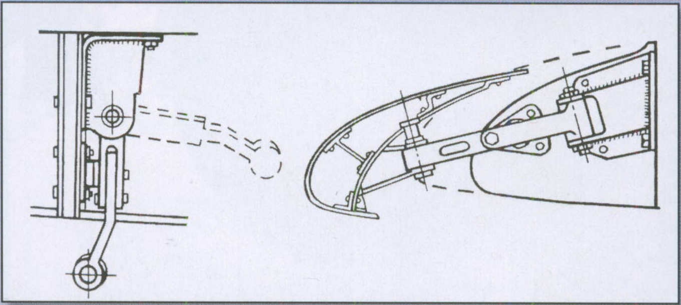
Here we see the pitot tube under the right wing. This configuration is typical of a late type MiG-3 equipped with automatic slats; early type MiG-3s had no slats, and the pitot tube was located on the wing leading edge.

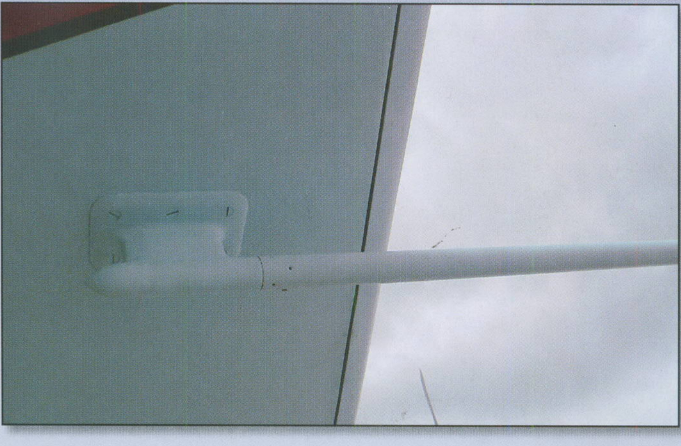
The images show the slats in the retracted position.

Automatic slats are free to move forward due to the air pressure at high angles of attack.



The move was due to two pivoting arms; the flap moves forward and sidewards, and a slightly downwards.
Wartime photos of extended slats are very rare, the usual position being the closed one, probably due to the angle of the plane on the ground.
This drawing of the pivoting arm was made on the basis of a similar installation on Lavochkins

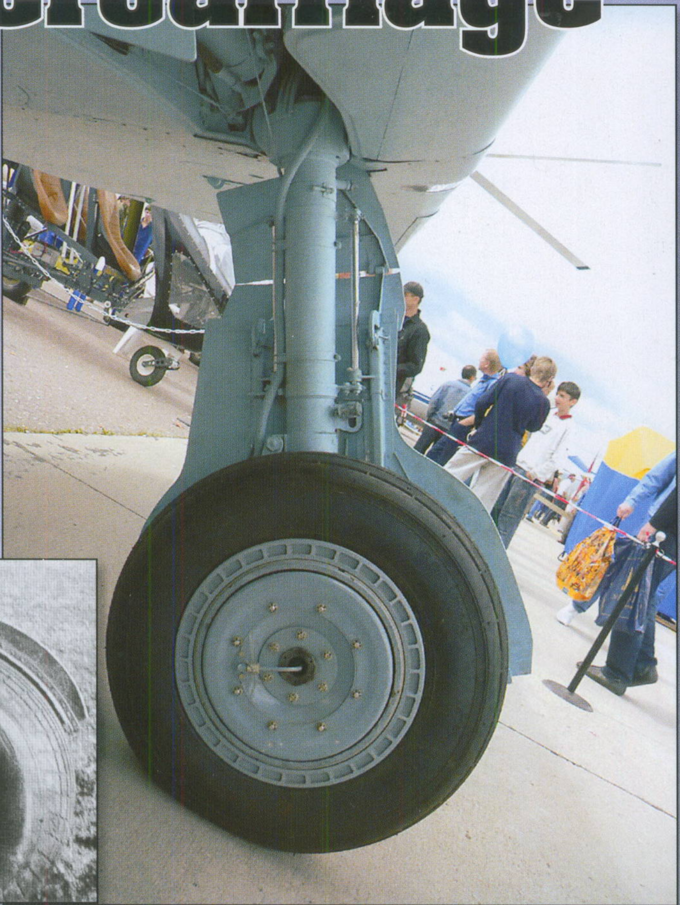




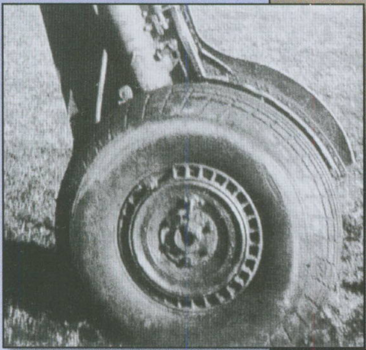
Undercarriage

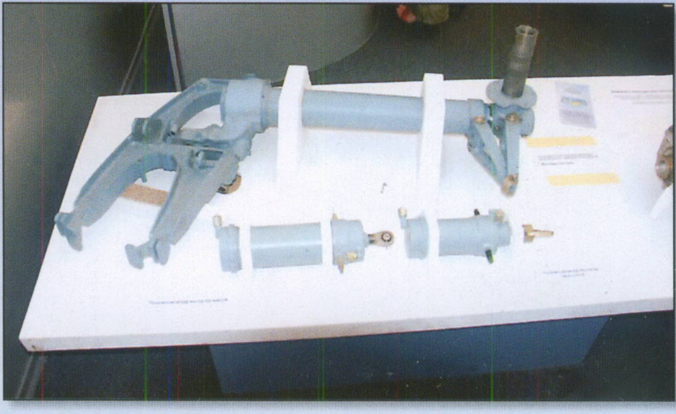
The main landing gear of the MiG-3 retracted by rotating inwards and slightly rearwards.
The tubed tires were 600x180 mm. On wartime MiG-3s, the wheel was painted green.

Yuri Pasholok

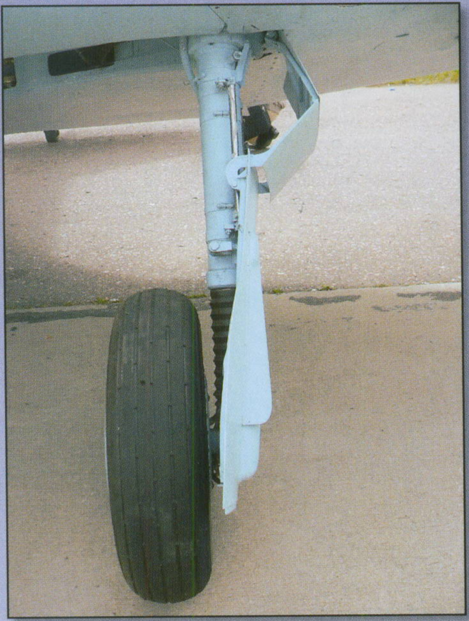


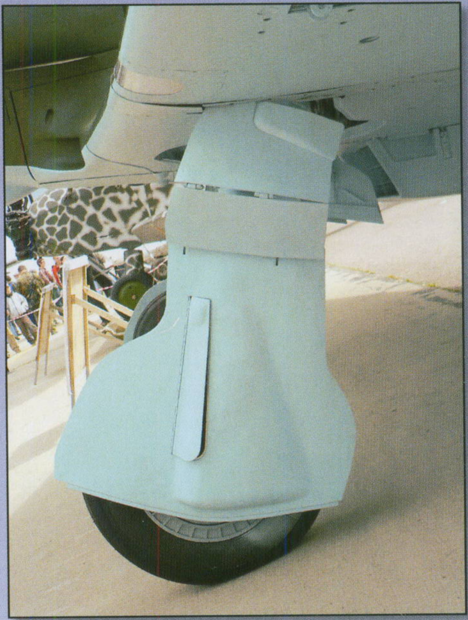
***Below**: an image of an original*

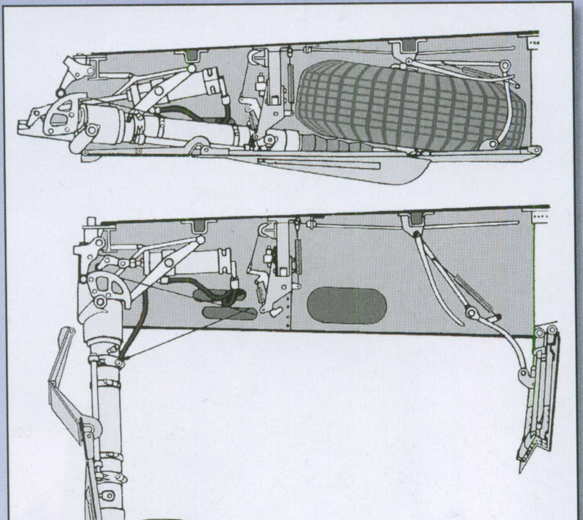




***Right**: Main landing gear leg.*
V.V Dyakonov







Above left: *The doors on each side were divided into five elements. The leg and inner face of the doors are painted light blue, as seen in wartime images.*

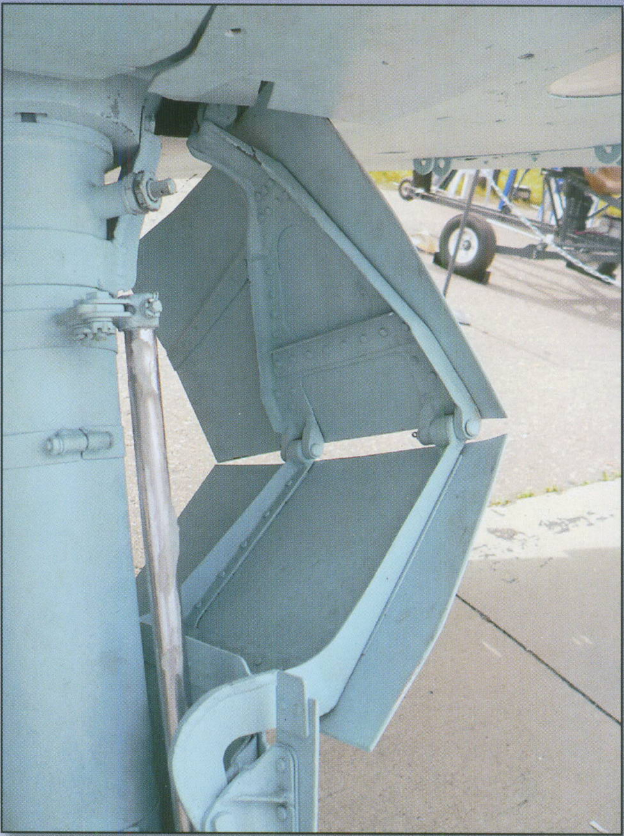
Above right:: *The fourth element is a narrow hatch hinged on its front side. allowing access for maintenance. The fifth element is the part of wheel cover hinged under the fuselage.*

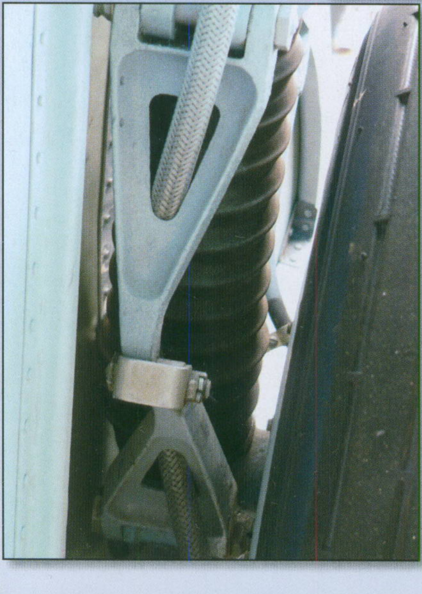
Both photos Yuri Pasholok

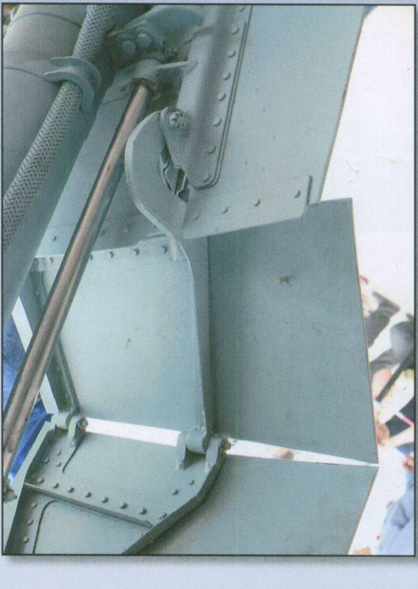
Left: *This drawing shows the main landing gear in the up and down position.*

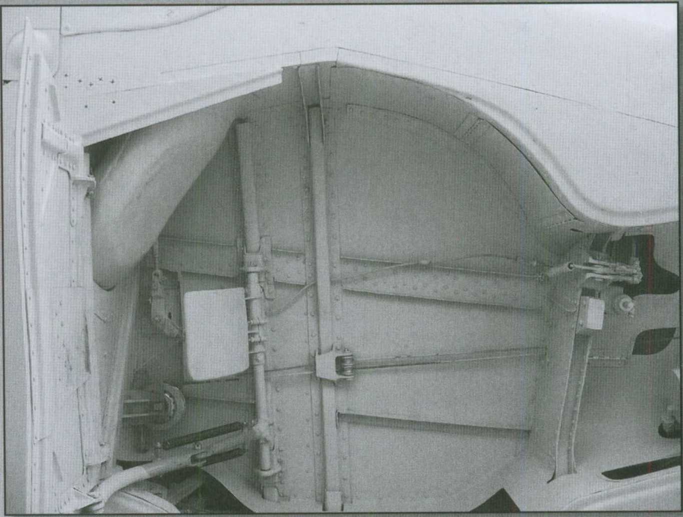
The left side upper elements of the main undercarriage door. The brake cable passing behind the leg is visible, as is the rear guide rod.
Image by Yuri Pasholok
The same from the front. Note that there are two guide rods for each leg.
Note the torque link, with the brake cable passing through it, and the rubber cover on the oleo.
The shock absorbers had a 270 mm stroke, and were filled with a 70/30 glycerine/alcohol mix.

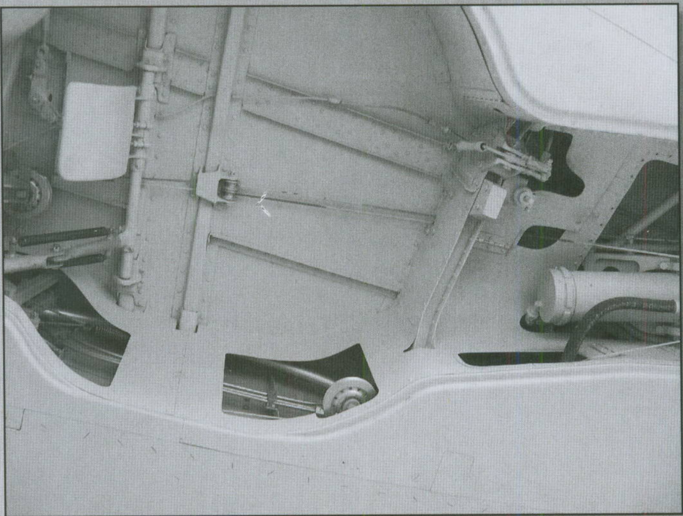
All photos Yuri Pasholok







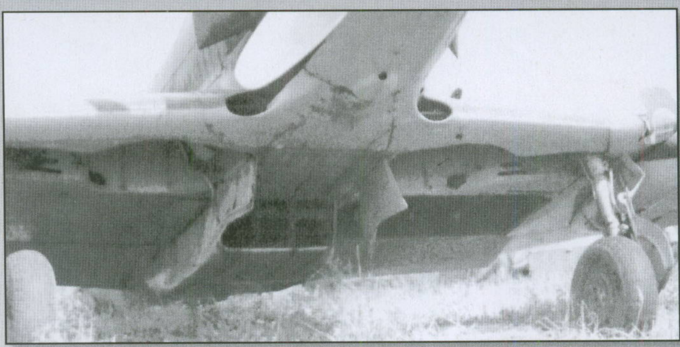




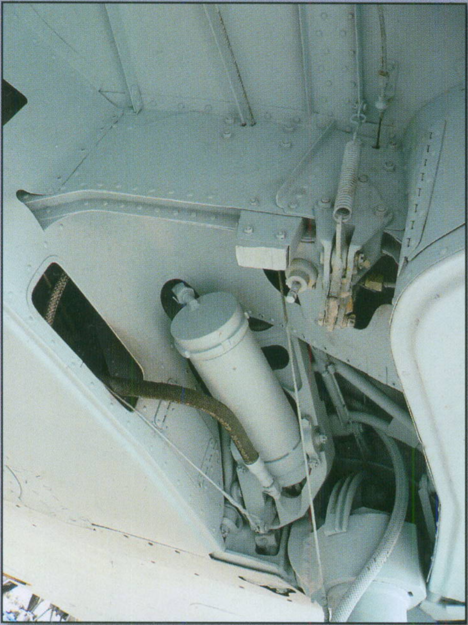
An overall view of the left wheel bay.
On the left side is the inner door closing mechanism.

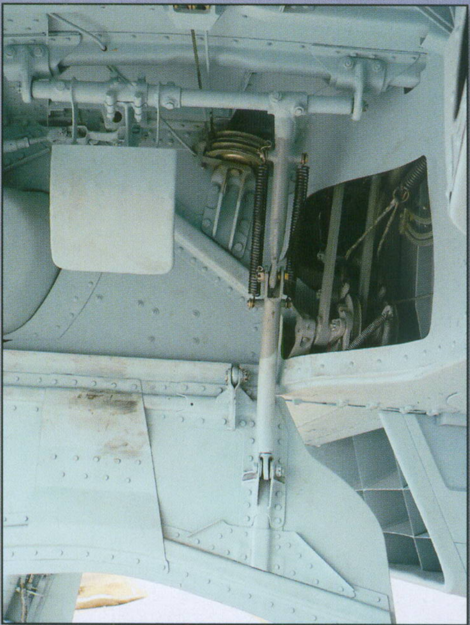
On the right side, is the pneumatic actuator for leg extension.

Note the thin recess for the closed doors all around the bay; so the bay itself is a bit smaller than the doors..
Both photos Yuri Pasholok



A wartime photo allows a comparison of the bay. We can see that two rectangular windows on the rear wall of the bay are closed by hatches.
Jan Koennig





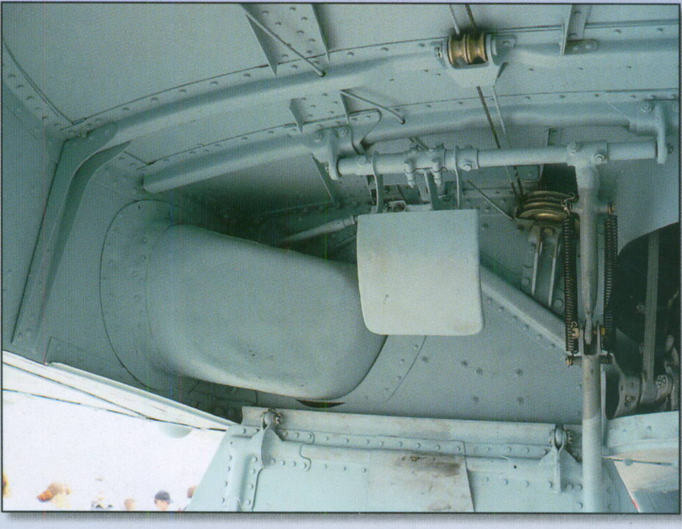
Above: *Port wheel bay. The pneumatic actuator and compressed air pipe are clearly visible.*
The upper end of the gear leg and the wheel brake cable are visible too.
On the right side of the image, we see the mechanism that locks the leg in the retracted position.

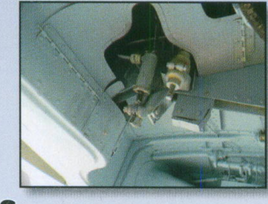
Above: *The door closing mechanism. When the landing gear is retracted, the wheel presses on the square plate, and this causes the rotation of the mechanism that pulls the door upwards. Two black springs made the mechanism stable in the fully closed and fully opened positions. The door could be closed manually for better access to the fuselage underside for maintenance.*

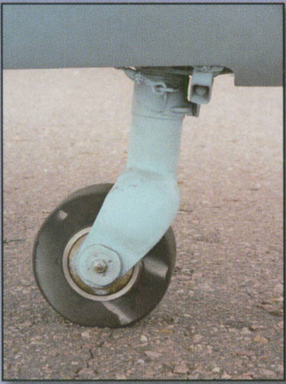
Right: *Inner part of the main wheel bay. The mechanism for opening/closing the door is visible. The air duct from wing root intakes to supercharger is also visible.*

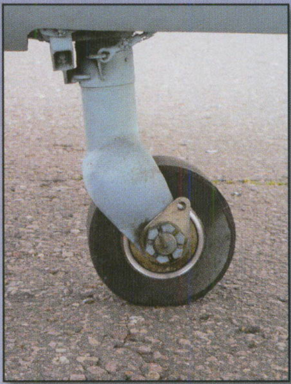
Below:*The retracted leg locking mechanism.*

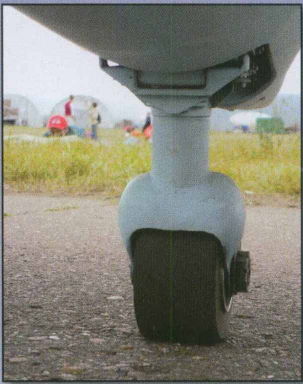
All photos Yuri Pasholok

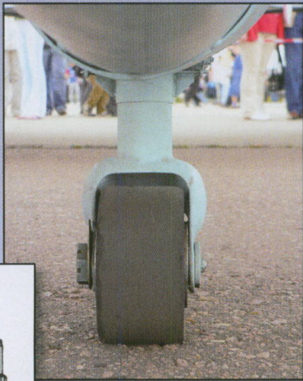






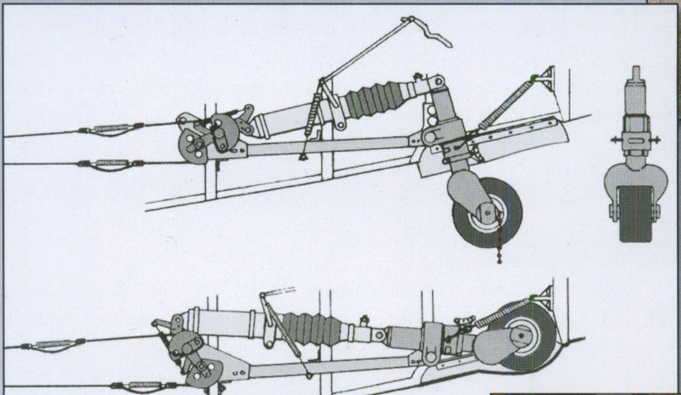


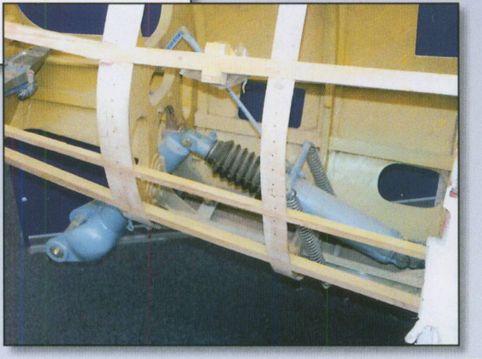




The tailwheel of MiG-3 retracted backwards, and its bay was closed by doors (not fitted here: flat on MiG-1, with a cut-out to allow the wheel to protrude on early type MiG-3; bulged on late type MiG-3. The doors were actuated by the rods visible on the upper leg sides. Retraction was unreliable, so the tailwheel was often locked in the open position and the doors removed. The bay was often sealed with a canvas cover.

All photos Yuri Pasholok





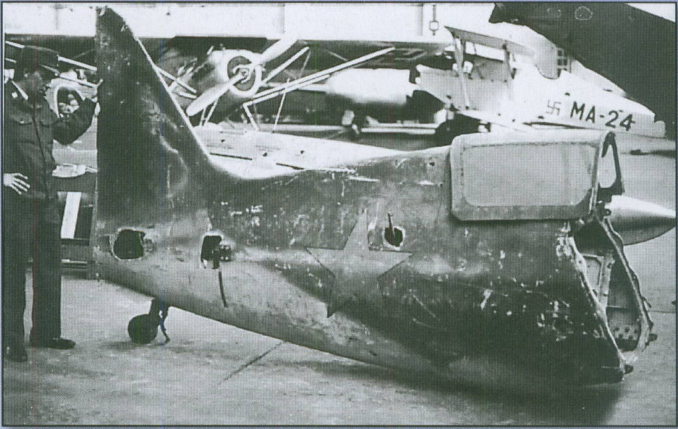
***Above**: This drawing shows the retraction mechanism in extended and retracted position.*

***Right**: The internal mechanism for tailwheel retraction. The cylinder is a shock adsorber.*

Vseslav V. Dyakonov

MiG 3 Survivors & Replicas

MiG-3 remains at the Central Finland Aviation Museum



Here is a photo of the rear fuselage of a MiG-3 in the Central Finland Aviation Museum. This image shows that the fuselage was painted in the factory before assembling the tail planes, while it looks that the plane received a second repainting of green after having assembled the wingroot fairing.

Photo copyright Central Finland Aviation Museum, courtesy of Kai Mecklin,

The wreckage in the Veesiveehma depot of the museum includes the rudder and tail surface of n.2171 (red 1); they show the use of dark red on trim tabs and number 1, that is outlined light green-blue. The wing of another MiG-3 is also stored there.

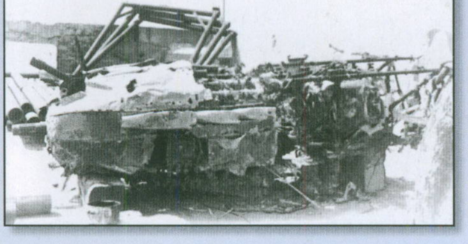
Dmitriy Sribny

MiG-3 replica in Monino Museum

A static replica was built and displayed in the 1967 Domodedovo Show, and then in the Monino museum. This replica has only a vague resemblance to an original MiG-3, and it is more like an early I-200. Despite the inaccurate

R.Bardokin

MiG-3 wreck recovered from the Black Sea



The wreckage of a MiG-3 (engine mount, engine and centre section) was found at the bottom of the Black Sea. This MiG-3 belonged to 7 IAP VVS ChF (Black Sea fleet), piloted by Fiodor Yegorov. The Anapa airfield of the regiment was close to the sea and the airstrip sloped down towards the water. The Mig-3 was not shot down, but crashed into the water after take off. The pilot didn't survive the crash. The MiG-3 was found about 1 km from the shore in front of the airstrip.

After the wreckage were lifted, it was stored at the port for a long time. The OKB Mikoyan had an interest in the wreck as well as the aviarestoration group of Novosibirsk, but were assured that the wreckage had been scrapped. In the museum of Anapa are stored the UB machine gun, the airscrew and the armoured seatback from this MiG

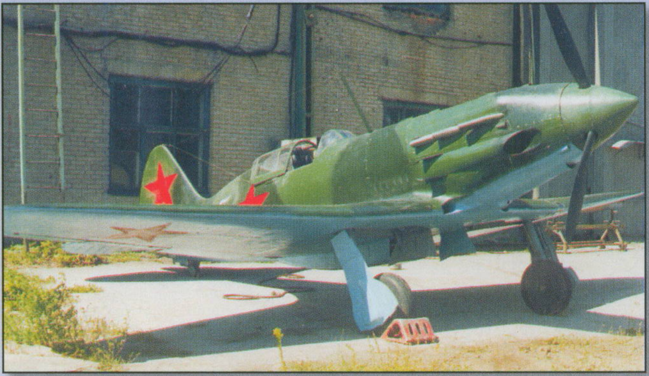
MiG-3 restored by Avion

The firm "Avion" restored a MiG-3 wreck over 14 months, painted as Pokryshkin's fighter of 1941.

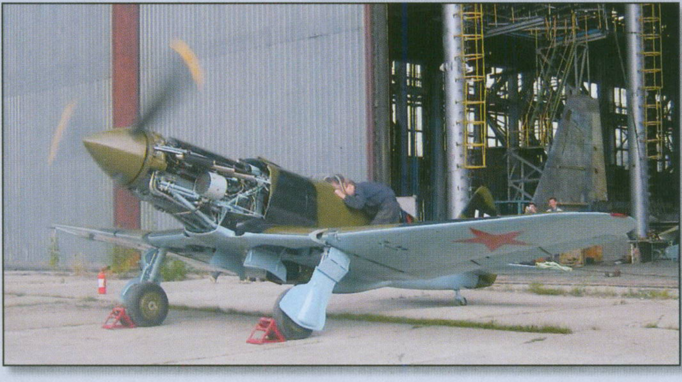
This plane was restored for the Monino museum, but it is still in Novosibirsk at the time of writing.

The restoration work appears very good, with compromises against originality on the landing gear, the engine cowling (that is a hybrid between early type and late type), the profile behind the canopy and the lack of pitot tube.

The firm "Avion" has restored many planes: flying I-16s and an I-153 "Chayka" (all for "Wanaka" in New Zealand), Su-2, P-63 "Kingcobra" (now in Monino), A-20G "Boston" (Monino), B-25C "Mitchell" (Monino) and others.



MiG-3 restored by Avion.
Kovalsky Alexey



MiG-3 restored by Aviarestoration.
Boris Osetinsky

MiG-3 restoration by Aviarestoration

The Russian company “Aviarestoration” of Novosibirsk has rebuilt a MiG-3 from parts of many recovered wrecks for the company Rusavia.

A MiG-3 wreck was found near Kandalaksha, Murmansk region, in 2000.

It comprised a centre-section, a fuselage frame and some fragments of tail. The second MiG-3, whose parts were used in the reconstruction, was found in the Loukhi region, Karelia, in 2001.

In addition, there are parts included from four other aircraft. Most of the equipment is original. The airframe has about 40% of its original parts. The almost complete aircraft was displayed at MAKS in 2005 with a dark green livery. In 2006 it was completed to airworthy condition, and repainted with green-black camouflage and a white 17 on its tail.

Bibliography & Links

This book is based on my web site http://mig3.sovietwarplanes.com/

Books and magazines

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http://eroplan.boom.ru/photo/mig-3/mig-3.htm a site with beautiful photos of the MiG-3 being restored in Novosibirsk.

http://www.airforce.ru/aircraft/mikoyan/mig-3/rusavia/index.htm MiG-3 under reconstruction in Russia by Aviarestoration for the Rusavia company. Photos by Vseslav V. Dyakonov

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llustrated story of the MiG-1 & 3 – the first design to bear the "signature" anovich Mikoyan and Mikhail Iossipovitch Gurevich, who made MiG a worldwide name. Even today, after the death of both men, the designation MiG is used for the quintessential Russian fighter. In 1940, the MiG-1 was a innovative and ground-breaking radical aircraft: a small, slim low-wing monoplane with a powerful but heavy engine. Difficult to fly, it was the foundation upon which the MiG Bureau made their first step to designing the best Soviet fighters.

The book examines the MiG-3's full history, covering how the initial problems were overcome, and how, from 1941 to 1943, the fighter fulfilled its potential in combat, being equal to all adversaries.

This work on the first new Soviet fighter of World War Two features: scale plans; photos and drawings from technical manuals; superb colour illustrations of camouflage and markings; walk-around colour photographs of surviving aircraft; rare black and white archive photographs from World War Two. It is essential reading for aviation history enthusiasts and scale modellers.

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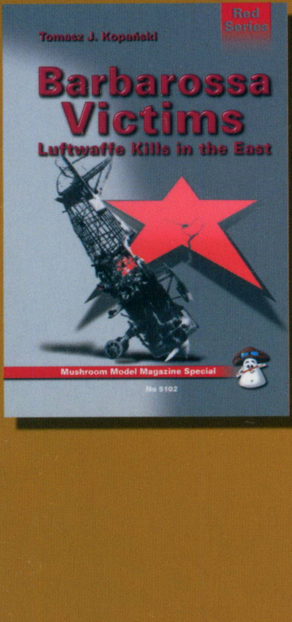
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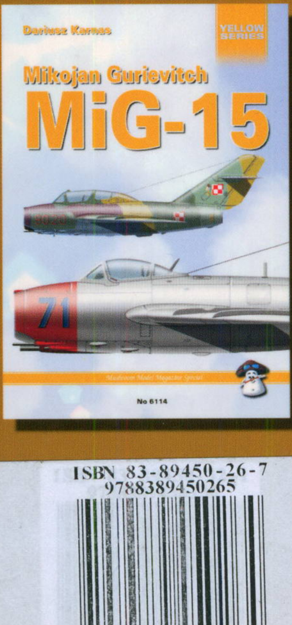
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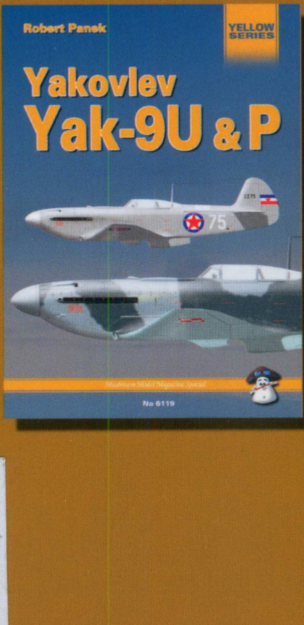
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